DOCUMENT RESUME

ED 259 124 CE 041 744

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TITLE Plastics Technology.
INSTITUTION Texas Univ., Austin. Extension Instruction and Materials Center.
SPONS AGENCY Texas Education Agency, Austin. Dept. of Occupational Education and Technology.
PUB DATE 84
NOTE 267p.
AVAILABLE FROM Extension Instruction and Materials Center, P.O. Box 7218, University of Texas, Austin, TX 78713-7218 (Stock No. IA 013 I).
PUB TYPE Guides - Classroom Use - Guides (For Teachers) (052)

EDRS PRICE MF01 Plus Postage. PC Not Available from EDRS.
DESCRIPTORS *Assembly (Manufacturing); *Entrepreneurship; Equipment Utilization; Finishing; Hand Tools; Individualized Instruction; *Industrial Arts; Junior High Schools; Leadership; Learning Activities; Lesson Plans; Machine Tools; Mass Production; Metals; Patternmaking; *Plastics; Safety; School Shops; *Shop Curriculum; State Curriculum Guides; Trade and Industrial Education; Youth Leaders

ABSTRACT

This curriculum guide is designed to assist junior high schools industrial arts teachers in planning new courses and revising existing courses in plastics technology. Addressed in the individual units of the guide are the following topics: introduction to production technology; history and development of plastics; safety; youth leadership, entrepreneurship, and laboratory management; material layout; introduction to plastics materials; introduction to plastics processes; and career opportunities. Each unit contains some or all of the following: objectives, key words, a list of teaching aids needed, suggested references, a sentence outline, a list of materials for students, suggested student activities, student worksheets, transparency masters, student handouts, and a unit test. An appendix to the guide contains a list of plastics resource materials. (MN)

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Plastics Technology

By

Tommy G. Barker

Published by

Extension Instruction and Materials Center

Division of Continuing Education

The University of Texas at Austin

Developed under a contract with

Occupational Education and Technology

Texas Education Agency

Austin, Texas

1984

CE 041744

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Stock Number IA 013 I

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Foreword

This publication is one of the new series of instructional materials for industrial arts education. It has been designed to assist teachers as they plan and implement new courses of study and make revisions and improvements in existing courses. This publication is an attempt to help industrial arts teachers create learning environments that respond to the needs of students growing up in a complex industrial-technical society. It provides a framework that enables teachers to integrate classroom learning with real life experiences of students.

Industrial arts is being challenged to expand and clarify its function. To meet this challenge, the industrial arts curriculum must provide opportunities for students to learn more about the technological realities in our society. This publication provides teachers with an instructional platform that focuses on industrial arts' commitment to establish its content base in the technologies.

Every effort has been made to produce a publication that addresses the unique needs of our current student population. Students with limited English proficiency (LEP) as well as handicapped, educationally disadvantaged, and nontraditional students may require modification of the material in this publication. The professional staff of EIMC will gladly work with any instructor having these students to show how the instructional material can be adapted for specific individualized instruction. Consult local, state, and federal agencies that offer assistance and guidance and that can provide sound recommendations for productive classroom management.

Kathryn R. Allen, Ph.D.
Acting Director, Extension Instruction
and Materials Center

COMPLIANCE STATEMENT

TITLE VI, CIVIL RIGHTS ACT OF 1964; THE MODIFIED COURT ORDER, CIVIL ACTION 5281, FEDERAL DISTRICT COURT, EASTERN DISTRICT OF TEXAS, TYLER DIVISION

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(3) nondiscrimination in extracurricular activities and the use of school facilities;

(4) nondiscriminatory practices in the hiring, assigning, promoting, paying, demoting, reassigning, or dismissing of faculty and staff members who work with children;

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(7) evidence of published procedures for hearing complaints and grievances.

In addition to conducting reviews, the Texas Education Agency staff representatives check complaints of discrimination made by a citizen or citizens residing in a school district where it is alleged discriminatory practices have occurred or are occurring.

Where a violation of Title VI of the Civil Rights Act is found, the findings are reported to the Office for Civil Rights, Department of Health, Education and Welfare.

If there is a direct violation of the Court Order in Civil Action No. 5281 that cannot be cleared through negotiation, the sanctions required by the Court Order are applied.

TITLE VII, CIVIL RIGHTS ACT OF 1964: EXECUTIVE ORDERS 11246 and 11375; TITLE IX 1973 EDUCATION AMENDMENTS: REHABILITATION ACT OF 1973 AS AMENDED; 1974 AMENDMENTS TO THE WAGE-HOUR LAW EXPANDING THE AGE DISCRIMINATION IN EMPLOYMENT ACT OF 1967; VIETNAM ERA VETERANS READJUSTMENT ASSISTANCE ACT OF 1972 AS AMENDED IN 1974.

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Acknowledgments

The Extension Instruction and Materials Center acknowledges with grateful appreciation the contribution that industrial arts professionals have made to the production technology curriculum materials. Their suggestions, comments, and criticisms have strengthened this series. These individuals contributed in the review and evaluation process:

- Dave Pullias, Richardson ISD
- Bill Hoffman, Spring Branch ISD
- Lloyd Gober, Austin ISD
- Gilbert Steelhammer, Austin ISD
- Jim LaPorte, Virginia Polytechnic Institute and State University
- Franzie Loepp, Illinois State University
- Willie Spencer, Houston ISD
- John Smart, McKinney ISD
- Bill Windham, Southwest Texas State University
- David Deitz, Gainesville ISD
- Jerry MyCue, Texas Education Agency
- John Emmons, Canton, Ohio City Schools
- Harold Berryhill, Iowa State Department of Public Instruction
- Tom LaClair, Liverpool, New York Central School District
- George Willcox, Virginia State Department of Education
- Charles Pinder, Virginia Polytechnic Institute and State University
- Lloyd Carter, Fort Worth ISD
- Rolando Salinas, Austin ISD
- Frank Mullen, Texas A&I University,
- Robert Carter, Plano ISD

Special recognition and appreciation is extended to the Center's Industrial Arts Advisory Committee for its leadership, guidance, encouragement, and recommendations during the development of this material:

- Benton Brockette, Chairman
- Dr. Daniel Householder
- Dr. W. A. Mayfield
- Ralph Schultz
- Jim Payne
- Daniel Jamie
- Kitt Sukup
- Dr. Clayton Allen

The Center is deeply indebted to Dr. Phillip Foster and Dr. Tommy Koonce of North Texas State University for their professional management and leadership as directors of the pilot program. We also thank Michelle Windsor and Dan Wood for their valuable assistance in the pilot program.

The industrial arts professionals who piloted the production technology curriculum materials have made it possible to enhance the education of our youth. We owe a debt of gratitude to these individuals:

- Steve Walker
- George Hyland
- Aubrey Ladner
- George Norrell
- Ray Garsch
- Sam Smithwick
- Jerry Cramer
- Clarence Alberts
- Raul Galindo
- Robert Hendershott
- Tommy Morgan
- Eddie English

The Center gratefully acknowledges the cooperation, support, and suggestions of the following members of the Texas Industrial Arts Curriculum Committee:

- Dr. Clayton Allen
- Dr. W. A. Mayfield
- Dr. Mike Kozak
- Dr. Billy Windham

A special thanks is due to Neil Ballard of the Texas Education Agency for his leadership, patience, support, and encouragement throughout the development of the production technology curriculum materials.

Written tests are only one method of assessing learning. Teachers will also need to evaluate a student on actual performance in each activity, on abilities, and on general progress toward reaching objectives. Each teacher should develop an evaluation system that provides the most accurate assessment of a student's progress.

Teachers may prefer to develop their own test instruments. However, their test items should focus upon objectives and course content. The test for each instructional unit in this curriculum material does focus on the objectives stated at the beginning of each unit and on unit content. A test key is also provided in the teaching aids section of each unit for the teacher's use in correcting tests.

Essential Elements

I. Essential Elements Common to all Vocational Education Programs
   A. Leadership concepts and skills
      The student shall be provided opportunities to—
      1. identify characteristics and responsibilities of leaders and effective group members;
      2. participate in orderly meetings conducted according to parliamentary procedure;
      3. function effectively on committees;
      4. plan and conduct leadership activities; and
      5. prepare for effective citizenship and participation in our democratic society.
   B. Concepts and skills related to successful employment
      The student shall be provided opportunities to—
      1. develop an awareness of employment opportunities in a chosen field;
      2. practice correct procedures for job application and interview;
      3. develop the ability to take and follow both oral and written directions;
      4. practice punctuality and dependability;
      5. observe rules and standards of the workplace;
      6. demonstrate an ability to work with others harmoniously;
      7. develop responsibility and the ability to follow through on assigned tasks; and
      8. exhibit productive work habits and attitudes.
   C. Concepts and skills associated with entrepreneurship
      The student shall be provided opportunities to—
      1. recognize opportunities and options for business ownership;
      2. identify entry-level procedures, planning processes, and terms needed to open a business; and
      3. develop an understanding of the role of small business in the free enterprise system.

II. Essential Elements Common to all Industrial Arts Programs
   A. Concepts and skills in the application of safety procedures
      The student shall be provided opportunities to—
      1. demonstrate safe operation and use of selected tools and equipment to avoid injury; and
      2. maintain safe conditions in the laboratory.
   B. Concepts and skills related to planning, designing, and problem solving
      The student shall be provided opportunities to—
      1. plan and design industrial products of the student's choice;
      2. measure accurately using metric and customary units;
      3. complete itemized list of materials; and
      4. make working drawings of projects.
   C. Concepts and skills related to the tools, materials, and process of technology
      The student shall be provided opportunities to—
      1. solve industrial problems by using a variety of industrial materials;
      2. use correctly selected hand and machine tools; and
      3. select the most suitable process to complete a project.
   D. Concepts and skills related to the past, present, and future of technology
      The student shall be provided opportunities to—
      1. recognize ideas and inventions of the past and present; and
      2. relate technological change to the skills needed for the future.

Notes to the Teacher

Using the Curriculum Material

Intended Audience. The material in this curriculum package is designed for use by junior high/middle school industrial arts teachers in exploratory/introductory programs.

Length of Time for the Material. The topic of study has been developed to provide enough material for eighteen weeks of study. Individuals who teach six-, nine-, or twelve-week classes can select parts of this curriculum material as the substance of their classes.

Emphasis of the Material. Keep in mind that this curriculum material is exploratory in nature. The emphasis is on exposing students to a wide range of experiences within the topic of study rather than on the development of technical expertise in one area.

Benefits for Teachers and Students. This material is designed to assist industrial arts teachers in the classroom as they reinforce and enhance students' skills in reading, mathematics, communications, problem solving, and social interaction. In addition, teachers who use this curriculum material will be able to help their students gain an understanding of and appreciation for management and work skills needed by individuals in the world of work. The broad exposure students receive in the topic of study will assist them in making meaningful career choices.

Flexibility of the Material. This curriculum material, like any other material, cannot encompass all situations. Therefore, teachers should feel free to supplement the material with other ideas, information, or activities as needed in their particular programs.

This material can be used in a number of different ways by industrial arts teachers. Some teachers may desire to use it as the starting point, a foundation upon which to build their own courses of study. Other teachers may prefer to teach the material as it is and add to it as they feel the need. Still other teachers may pick and choose only selected parts of this curriculum for use in their classes.

Teachers may also need to make substitutions in the curriculum depending on the equipment or references available. Other circumstances may also require teachers to make curriculum substitutions. The flexibility of this material enables teachers to use it in various ways and under various conditions. This curriculum provides teachers with an alternative in course design.

Competencies. Competencies have been identified for the topic of study. As used in this material, competencies represent skills, knowledge, or attitudes that imply the ability or intelligence to accomplish a task or job. They represent the instructional intent and are stated as specific goals to be achieved. Competencies assist teachers and students in clearly formulating a purpose for learning.

Organization of the Curriculum Material

The material in this topic of study is organized into instructional units. The framework used to develop each unit consists of a number of components. These components focus on (1) outcomes, (2) materials, (3) content, (4) activities, and (5) evaluation. The components are further divided and standardized in each topic of study. An explanation of each part in the instructional unit follows.

Objectives. Objectives have been identified for each instructional unit. The objectives reflect the kind of performance necessary to successfully complete a task or job. These objectives enable a student to attain the stated competencies. Furthermore, each unit's objectives are reflected in the content, student activities, and tests for that unit.

Objectives help the teacher and the student to focus upon the important concepts to be learned in each unit. Teachers may want to duplicate the competencies and objectives and give them as handouts to the students.

Key Words: Vocabulary. New words or terms are listed to enable you to help students develop their vocabulary. Some words or terms may be listed in several units because they are used throughout a topic of study. The repetition helps reinforce vocabulary building. A student vocabulary worksheet has been included with each unit.

Teaching Aids. The materials, equipment, and supplies identified in this section will enable the teacher to plan and organize instruction better. Teachers need to review this list of teaching aids before the day of instruction since some substitutions in equipment may be needed under certain conditions. A test key has been included to help the teacher in correcting the unit test.

Each transparency in this unit is also listed and briefly described. Transparency masters are provided at the end of each unit. The transparencies are keyed to a point in the sentence outline where their use is considered most appropriate. In addition to being used as transparencies, the masters may be duplicated and used as student handouts if the teacher so desires. Teachers may design or develop other transparency material that they feel enhances their instruction.

Suggested References. Many of the publications listed are available from textbook publishers. However, the reading level of these textbooks is often above junior high/middle school grade level. The material listed in this section is suggested for use by teachers as a way to supplement their knowledge in the subject area. Teachers can review these references and use selected material as supplements to their lectures and demonstrations when appropriate. Some of the sources suggested offer free or inexpensive materials that teachers may use with their students.

Sentence Outline. The information presented in this section represents the conceptual focus of the unit. The ideas and concepts are presented in a sentence outline, as a guide from which to teach. The outline should serve as a reference from which teachers can provide instruction.

The intent was not to needlessly duplicate material that is readily available to teachers. Rather, the intent was to provide teachers with basic ideas and information that may be less accessible. The suggested references and other resources can be used by teachers to build a knowledge base from which they can synthesize relevant concepts and information. Suggested references can be used to supplement, expand, and clarify learning activities and instruction.

Materials for Students. Suggestions to teachers regarding student materials may also be listed here. Student handout materials, such as exercises, charts, and graphs, are provided at the end of each unit when appropriate. These student handouts immediately follow the suggested student activities section. Handout materials may be reproduced and given to students.

Suggested Student Activities. The suggested activities are designed to reinforce and provide real applications of the concepts and content within each unit. These activities have been designed to use existing facilities and equipment, as much as possible. Another consideration was the cost factor. Suggested activities are designed to require minimum cost.

Each teacher should, therefore, examine the activities and select those which are appropriate for their students. Teachers can change or modify the suggested activities if equipment, materials, and funds are not available. Teachers need to be selective in the activities they use since some activities take longer than others. Some are designed for group activity while others are for individual work. The teacher's content emphasis must also be considered. Each of the activities has been designed to reinforce and enhance basic skills that students need in everyday life.

Tests. Each unit has a multiple-choice test to assist teachers in evaluating student achievement. Multiple-choice tests provide certain advantages for teachers in evaluating the teaching-learning process. They do not capitalize on chance answers to the extent that true-false tests do. Careful development of test answers will help teachers evaluate a student's comprehension of important concepts. This also provides teachers with an easy way to assess the effectiveness of their instruction through item analysis.

E. Concepts and skills related to evaluating products and services of technology
The student shall be provided opportunities to—
1. recognize good design and construction;
2. evaluate products based on given standards or applications;
3. service industrial products and equipment; and
4. develop criteria for selecting, purchasing, and contracting services.

III. Concepts and Skills Related to Production Technology
The student shall be provided opportunities to—
A. apply industrial organization and management systems by planning, organizing, and controlling production processes;
B. apply primary industrial processes of layout, testing, separating and cutting, drilling and boring, shaping and forming, casting, laminating, coating, decorating, joining, and finishing;
C. research the recycling of industrial materials;
D. plan and implement the various steps in the construction process;
E. research the transformation of raw materials into finished products;
F. plan and implement mass production activities;
G. demonstrate techniques and processes used in automated production systems; and
H. use computers in planning, production, quality control, and management of production systems.

IV. Concepts and Skills Related to Production Technology in the Area of Manufacturing
The student shall be provided opportunities to—
A. participate in activities involving product researching, designing, and marketing;
B. investigate financial resources needed in industrial production;
C. plan and implement mass production activities;
D. apply industrial organization and management systems by planning, organizing, and controlling production processes;
E. develop production charts and graphs;
F. demonstrate an awareness of automated systems used in manufacturing;
G. recognize basic material standards and terminology used in industry;
H. apply the basic industrial processes to manufacturing;
I. research the recycling of manufactured materials; and
J. use computers in planning, production, quality control, and management of production systems.

Competencies for Plastics

- Develop basic skills in the safe use and maintenance of tools and machines related to the plastics industry.
- Develop creative skills related to planning, designing, and problem solving in the fabrication and use of plastics.
- Develop skills related to the tools, materials, and processes used in the plastics industry.
- Develop an awareness of the past, present, and emerging processes used in the plastics industry.
- Develop an understanding of the concepts of good design and construction related to plastics products.
- Develop an awareness of industrial organization and management systems used in industrial production of plastics products.
- Develop an understanding of the importance of recycling plastics materials.
- Develop an understanding of the principles involved in the transformation of raw materials into finished plastics products.
- Develop an understanding of mass production used in the plastics industry.
- Develop an awareness of computerized and automated systems used in plastics production.
- Develop an understanding of the plastics industry and its relationship with today's technology.
- Develop an awareness of the opportunities for a socioeconomic future in the area of plastics.

1

Introduction to Production Technology

OBJECTIVES

After students have covered the material in this unit, they should be able to—

1. explain why the study of production technology is important;
2. describe manufacturing technology;
3. distinguish between primary and secondary manufacturing processes;
4. distinguish between part, subassembly, and product manufacturing;
5. identify and describe the three basic types of manufacturing—custom, continuous, and intermittent;
6. define prototype;
7. give examples of flexible control devices;
8. list some of the causes of pollution;
9. list the types of pollution; and
10. explain the importance of proper waste disposal and recycling.

KEY WORDS: VOCABULARY

The words in the following list may be new to the student studying plastics. Teachers should help students understand these words as they are used in this topic of study.

production technology
primary manufacturing processes
custom manufacturing
intermittent manufacturing
computer numerical control
prototype
pollution
manufacturing
secondary manufacturing processes
continuous manufacturing
numerical control
adaptive control
robotics
recycling
thermoforming
extrusion
compression molding
injection molding
rotational casting
blow molding
laminating

TEACHING AIDS

- Overhead projector
- Films
- Filmstrips
- Slides
- Charts
- Some of the materials listed in Appendix A can be used as teaching aids when appropriate.
- Test Key: 1-B, 2-C, 3-A, 4-C, 5-D, 6-A, 7-B, 8-D, 9-C, 10-D, 11-A, 12-B, 13-B, 14-D, 15-A, 16-D, 17-B, 18-A, 19-D, 20-B, 21-C, 22-D, 23-A, 24-C
- Transparencies: You will find transparencies PL1-1 through PL1-12 at the end of this unit. If you wish, these masters may be duplicated in quantity and given as handouts to the students while they are studying different aspects of this unit.
  PL1-1: Industry
  PL1-2: Manufacturing
  PL1-3: Manufacturing Processes

PL1-4: Examples of Plastics Processes—Forming
PL1-5: Examples of Plastics Processes—Separating
PL1-6: Examples of Plastics Processes—Combining
PL1-7: Types of Manufacturing
PL1-8: Conventional NC System
PL1-9: Computer Numerical Control System
PL1-10: Adaptive Control System
PL1-11: Robotics
PL1-12: Common Pollution Problems

SUGGESTED REFERENCES

The references listed here represent only a few of those available. Other information can be obtained from the U.S. Government Printing Office, The Society of the Plastics Industry, The Society of Plastics Engineers, and The Plastics Education Foundation. Periodicals such as Plastics Technology, Plastics World, Plastics Engineering, Modern Plastics, Modern Plastics Encyclopedia, and Plastics Design and Processing are excellent sources of information on all phases of the plastics industry. Trade publications are often available in classroom quantities free of charge. Many of these trade publications contain information that can be of great assistance to teachers and students. Educational publications, such as Industrial Education, School Shop, and Technology Teacher, provide up-to-date information about teaching techniques and aids that are available to the plastics teacher.

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SENTENCE OUTLINE

I. Why study production technology?
   A. Production technology includes the study of processes: construction and manufacturing. (Transparency PL1-1)
   B. Production technology includes the study of materials—plastics, metals, woods.
      1. A material is a solid, liquid, or gas out of which a thing is made.
      2. Plastics includes the study of synthetic substances composed of polymer molecules, characterized by high molecular weight, which will flow into a given form when under heat and pressure.

II. What is manufacturing?
   A. Manufacturing, as an enterprise, is a factory-based, profit-making organization.
   B. Manufacturing usually includes the making of products in large quantities by hand and machine. (Transparency PL1-2)
      1. Part manufacturing produces basic components for a product.
      2. Subassembly manufacturing is the joining of two or more parts to form a portion of a product.
      3. Product manufacturing is the joining of two or more parts and/or subassemblies to produce a completed product.
   C. Primary manufacturing processes include activities that convert raw materials into industrial materials (standard stock).
   D. Secondary manufacturing processes include activities that convert standard stock into consumable products. (Transparencies PL1-3 - PL1-6)
   E. Secondary plastics manufacturing processes include:
      1. Thermoforming. Sheet plastic is heated and forced into a mold surface.
      2. Extrusion. Softened plastic is forced through a die or hole.
      3. Compression molding. Softened plastic is compressed as it is forced into a mold under heat and pressure.
      4. Injection molding. Softened plastic is forced into a cavity or die.
      5. Rotational casting. It is used to make hollow products by coating the inside of a mold until the plastic hardens.
      6. Blow molding. Softened plastic is forced into the shape of a mold by air pressure.
      7. Laminating. This refers to the bonding of several layers of plastic coated materials under heat and pressure.
      8. Other processes, such as casting, dip coating, or foaming

III. Three basic types of manufacturing
   A. Custom manufacturing (Transparency PL1-7)
      1. Custom manufacturing is the oldest type of manufacturing.
      2. Custom manufacturing depends on highly skilled workers who usually use simple machines and hand tools.
      3. Custom manufacturing is seldom used to produce consumer products.
      4. Specialization of skills has replaced the "broad total craftsman" who carried out the production of a product from start to finish.

5. Custom manufacturing principles are used in building prototypes and unusual one-of-a-kind items.
   a. A prototype is anything of a certain shape, size, and quality (in which all parts work) that will be copied.
   b. Prototypes are built and tested prior to the selection of a final product design.

B. Continuous manufacturing (line production)
1. Continuous manufacturing is based on a constant, uniform flow of parts or products from operation to operation.
2. The equipment is arranged to handle the step-by-step sequence of operations by moving the material in a fixed predetermined path: elevators, conveyors, chutes, and so on.
3. Continuous manufacturing is used when large numbers of identical products are needed.

C. Intermittent manufacturing (batch production)
1. In intermittent manufacturing, the material is moved in "lots" by forklifts, tractors, cranes, and so on.
2. Machines are grouped according to the process they perform: cutting machines together, as are forming and molding machines, and so on.
3. The majority of the parts, across the spectrum of industries, are produced in lots of 50 or less at a time. Intermittent manufacturing is—
   a. used when the volume is too low to support a single production line. Large products, such as airplanes, are not made by the thousands.
   b. used when continuous manufacturing is not practical.
4. Many parts or subassemblies, used in continuous manufacturing, are manufactured using intermittent techniques.
5. Flexible control devices have resulted from intermittent manufacturing of a variety of parts in smaller quantities (10 - 1,000).
   a. Numerical control (NC), using punch tape, became an integral part of computer-aided manufacturing during the early 1970s. (Transparency PL1-8)
   b. The microcomputer, with control information drawn from the electronic memory, allowed direct input at the machine location. It is referred to as computer numerical control (CNC). (Transparency PL1-9)
   c. Adaptive control (AC), a system that can sense differences in process variables, determines the optimum speed and feed during the actual machining and makes changes to improve or optimize the performance. (Transparency PL1-10)
6. Robotics mixes mechanical, electrical, and computer technology. (Transparency PL1-11)
   a. Multiple-arm robots are becoming commonplace.
   b. Mobile robots are currently being used in industrial applications.
   c. Many current jobs are being phased out by robots, such as material transport, spray painting, die casting, and so on.

IV. Manufacturing and the environment
A. America is a victim of energy shortages and environmental problems.
B. Pollution is caused by automobiles, airplanes, home heating, hospitals, power plants, and others.
C. The primary cause of pollution, however, is technology.
1. We produce and use. Often nothing more is taught about the importance of conservation.
2. Recycling must be a part of technology. This refers to changing waste products back into raw materials.

D. Types of pollution (Transparency PL1-12)

1. air pollution—caused primarily by the combustion of materials
2. water pollution—caused by the discharge of individual, municipal, industrial, and agricultural waste
3. soil pollution—caused by any substance added to the soil that directly or indirectly impairs the health of animals and humans
4. thermal pollution—caused by excessive heat in the environment which raises the earth's temperature

E. Plastic products present special environmental problems because they do not decompose as easily and quickly as wood and metal.
   1. Plastic products account for about 2-5 percent of the solid waste materials disposed of in the United States each year.
   2. Plastic waste litters the landscape, pollutes the waters, and presents safety hazards to wildlife.
   3. Plastic materials may be disposed of by—
      a. burning in incinerators, which pollutes the air; and
      b. covering with dirt in a sanitary landfill, which helps to reclaim the land and allows the products to eventually decompose.
   4. Recycling plastics seems to be the most appropriate solution to the environmental problems created by the increased usage of plastic materials.
      a. Recycling may take the form of regrinding sprues and plastic waste in a manufacturing plant.
      b. Postconsumer recycling presents the problems of separation and identification of materials prior to reprocessing.
      c. Many industrial corporations are experimenting with various methods of reclaiming and reprocessing plastic materials.
      d. The consumer is the key to the pollution and recycling problems created by the use of plastics. People must be educated to dispose of waste properly and take reclaimable material to recycling centers.

MATERIALS FOR STUDENTS

- Vocabulary worksheet
- Newspapers, magazines
- Poster board or paper
- Notebook (preferably, a 3-ring binder)
- Marking pens

SUGGESTED STUDENT ACTIVITIES

1. Begin a Plastics Notebook. Include news clippings from the daily newspaper and/or magazines that relate to the plastics industry. This activity should be ongoing throughout the topic of study. Include a vocabulary/key word section.
2. Begin a class plastics bulletin board. Have students maintain and change the items on the board.
3. Arrange a field trip, or show a film that explains automation.
4. Do a time study of how individuals at school pollute the environment.
5. List several manufacturing enterprises, possibly in your city or town.
6. List several articles in your home that were manufactured.
7. Working in small groups, have the students select one of the following activities:
   a. Product analysis
      (1) Discuss how the product was made. Examine clues, such as surface appearance, weight, thickness, and so on.
      (2) List primary and secondary processes that may have been used.
      (3) List various types of machines that may have been used.

(4) Prepare a written report.
(5) Present your findings to the class.

b. Flexible control devices research
(1) Select a current flexible control device.
(2) Research how the device was developed.
(3) Prepare a written report.
(4) Present your findings to the class.

c. Recycling research
(1) Research how the plastic is currently being recycled.
(2) Prepare a written report.
(3) Present your findings to the class.

8. List several reasons why a study of manufacturing could be of value to you.
9. List several reasons why a study of plastics could be of value to you.
10. Locate examples of part manufacturing, subassembly manufacturing, and product manufacturing.
11. Using plastics, woods, and metals, list examples of standard stock.
12. Set up the manufacturing of a simple product for students to make. Prepare all jigs, fixtures, and standard stock prior to the activity.
13. Have a spelling bee using the vocabulary words. Students can add to the vocabulary list from their outside reading.
14. Explain why intermittent manufacturing lends itself to a school laboratory environment.

Vocabulary Worksheet

1. production technology
2. primary manufacturing processes
3. custom manufacturing
4. intermittent manufacturing
5. computer numerical control
6. prototype
7. thermoforming
8. extrusion
9. compression molding
10. pollution
11. manufacturing
12. secondary manufacturing processes
13. continuous manufacturing
14. numerical control
15. adaptive control
16. rotational casting
17. blow molding

18. laminating

19. robotics

20. recycling

21. injection molding

TEST

Unit 1: Introduction to Production Technology

Directions: Read each statement carefully. Select the word or phrase that correctly answers or completes the statement, and write the appropriate letter in the blank.

Example: __C__ 21. The class that you are in is—

A. American Government
B. Language Arts
C. Industrial Arts
D. General Science

___ 1. Production technology includes the study of—

A. energy/power and construction
B. construction and manufacturing
C. manufacturing and visual communications
D. visual communications and energy/power

___ 2. Production technology involves the study of—

A. ceramics, leather, plastics
B. plastics, wood, leather
C. plastics, metal, wood
D. ceramics, wood, metal

___ 3. A factory-based, profit-making organization is a definition for a—

A. manufacturing enterprise
B. construction company
C. production corporation
D. industrial activity

___ 4. Producing basic components for a product is—

A. subassembly manufacturing
B. primary manufacturing
C. part manufacturing
D. product manufacturing

___ 5. The joining of two or more parts and/or subassemblies to produce a completed product is—

A. subassembly manufacturing
B. primary manufacturing
C. part manufacturing
D. product manufacturing

___ 6. The joining of two or more parts to form a portion of a product is—

A. subassembly manufacturing
B. primary manufacturing
C. part manufacturing
D. product manufacturing

___ 7. Activities that convert raw materials into industrial materials are involved in—

A. subassembly manufacturing
B. primary manufacturing
C. product manufacturing
D. secondary manufacturing

___ 8. Activities that convert standard stock into consumable products are involved in—

A. subassembly manufacturing
B. primary manufacturing
C. product manufacturing
D. secondary manufacturing

___ 9. Material transport, spray painting, and die casting are current jobs being replaced by—

A. CNC
B. lasers
C. robots
D. tracers

___ 10. The oldest type of manufacturing is—

A. continuous manufacturing
B. intermittent manufacturing
C. primary manufacturing
D. custom manufacturing

___ 11. A type of manufacturing that uses conveyors, elevators, etc., is—

A. continuous manufacturing
B. intermittent manufacturing
C. primary manufacturing
D. custom manufacturing

___ 12. Machines are grouped according to process in—

A. continuous manufacturing
B. intermittent manufacturing
C. primary manufacturing
D. custom manufacturing

___ 13. Flexible control devices are a direct result of the use of—

A. continuous manufacturing
B. intermittent manufacturing
C. primary manufacturing
D. custom manufacturing

___ 14. Consumer products are seldom produced by—

A. continuous manufacturing
B. intermittent manufacturing
C. primary manufacturing
D. custom manufacturing

___ 15. A type of manufacturing used when large numbers of identical products are needed is—

A. continuous manufacturing
B. intermittent manufacturing
C. primary manufacturing
D. custom manufacturing

___ 16. Prototypes are mainly produced using—

A. continuous manufacturing
B. intermittent manufacturing
C. primary manufacturing
D. custom manufacturing

___ 17. This is used when the volume is too low to support a single production line:

A. continuous manufacturing
B. intermittent manufacturing
C. primary manufacturing
D. custom manufacturing

___ 18. A type of manufacturing based on constant, uniform flow of parts is—

A. continuous manufacturing
B. intermittent manufacturing
C. primary manufacturing
D. custom manufacturing

___ 19. This is mainly used in producing unusual, one-of-a-kind items:

A. continuous manufacturing
B. intermittent manufacturing
C. primary manufacturing
D. custom manufacturing

___ 20. Forklifts, tractors, cranes, etc., are employed in—

A. continuous manufacturing
B. intermittent manufacturing
C. primary manufacturing
D. custom manufacturing

___ 21. A type of control that determines the optimum speed and feed during the actual machining and makes changes to improve the performance is—

A. numerical control
B. flexible numerical control
C. adaptive control
D. computer numerical control

___ 22. Direct input at the machine location is allowed in—

A. numerical control
B. flexible numerical control
C. adaptive control
D. computer numerical control

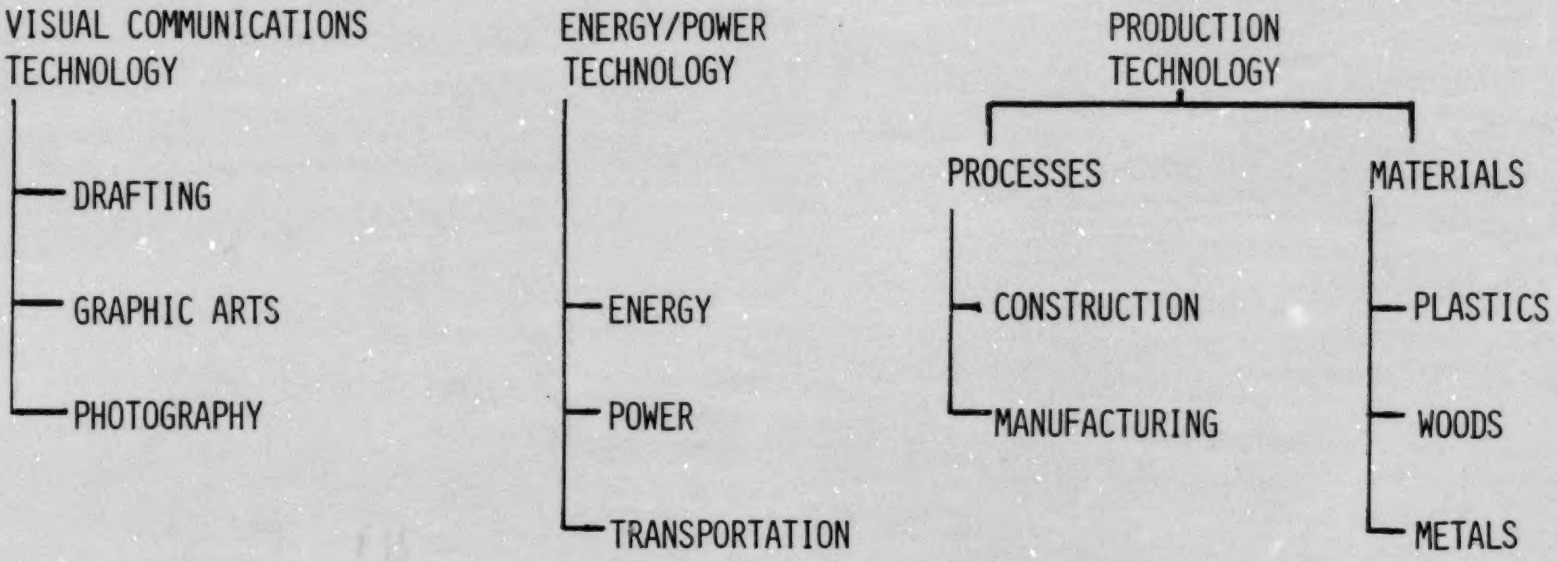
___ 23. Punch tape is used in—

A. numerical control
B. flexible numerical control
C. adaptive control
D. computer numerical control

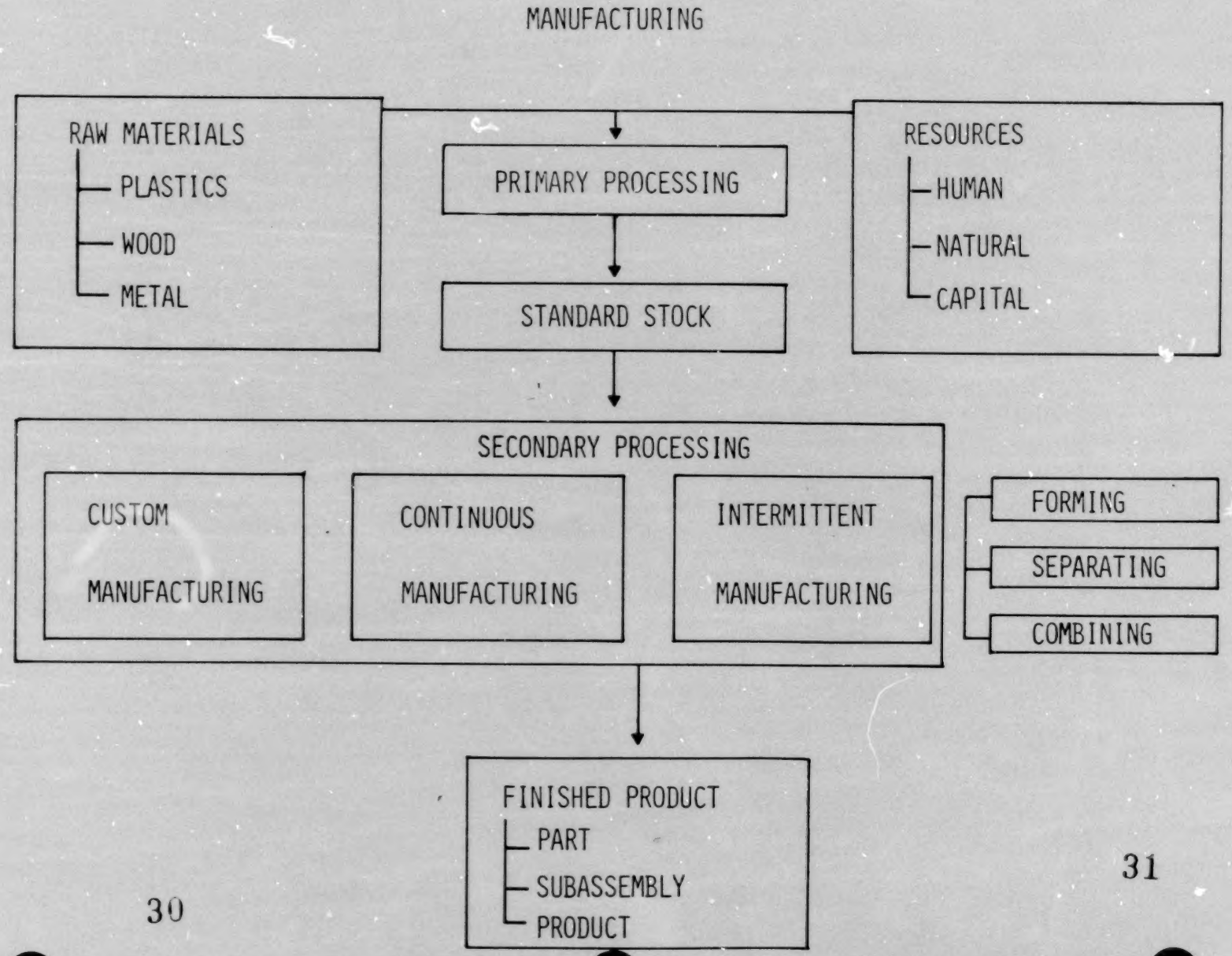
___ 24. The primary cause of pollution is—

A. automobiles
B. home heating
C. technology
D. airplanes

PL1-1



INDUSTRY


MANUFACTURING
RAW MATERIALS
PLASTICS
WOOD
METAL
PRIMARY PROCESSING
STANDARD STOCK
RESOURCES
HUMAN
NATURAL
CAPITAL
SECONDARY PROCESSING
CUSTOM MANUFACTURING
CONTINUOUS MANUFACTURING
INTERMITTENT MANUFACTURING
FORMING
SEPARATING
COMBINING
FINISHED PRODUCT
PART
SUBASSEMBLY
PRODUCT

PL1-2

MANUFACTURING PROCESSES

FORMING

- CASTING OR MOLDING
- COMPRESSING AND STRETCHING
- CONDITIONING

SEPARATING

- SHEARING
- CHIP REMOVING
- OTHER

COMBINING

- MIXING
- COATING
- BONDING
- MECHANICAL FASTENING

EXAMPLES OF PLASTICS PROCESSES

FORMING

- CASTING/MOLDING
  - INJECTION MOLDING
  - ROTATIONAL CASTING
  - BLOW MOLDING
- COMPRESSION/STRETCHING
  - EXTRUSION
  - COMPRESSION MOLDING
  - LAMINATING
  - THERMOFORMING
- CONDITIONING
  - CASTING
  - SOFTENING

EXAMPLES OF PLASTICS PROCESSES

SEPARATING

SHEARING

SHEARING

HOT WIRE

CHIP REMOVAL

FILING

SANDING

SAWING

DRILLING

MACHINING

CARVING

OTHER

ETCHING

EXAMPLES OF PLASTIC PROCESSES

COMBINING

- MIXING
  - RESIN
  - FIBERGLASS
  - REINFORCED PLASTICS
- COATING
  - PAINTING
  - PLATING
- BONDING
  - PLASTIC WELDING
  - SOLVENT CEMENT
  - GLUING
- MECHANICAL FASTENERS
  - RIVETING
  - BOLTING
  - SCREWING

TYPES OF MANUFACTURING

CUSTOM MANUFACTURING

- PROTOTYPES
- ONE OF A KIND OBJECTS

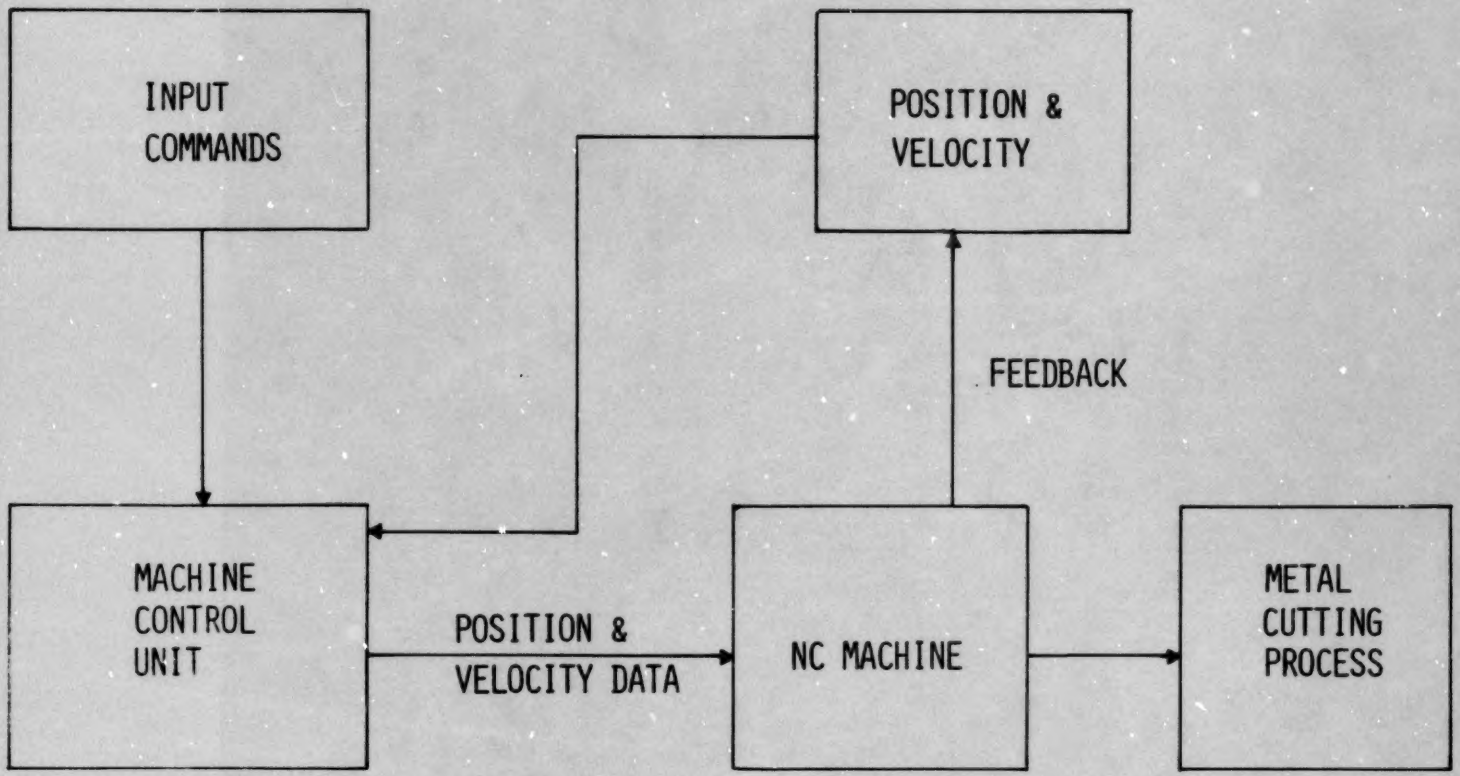
CONTINUOUS MANUFACTURING

- LINE PRODUCTION
- MASS PRODUCTION

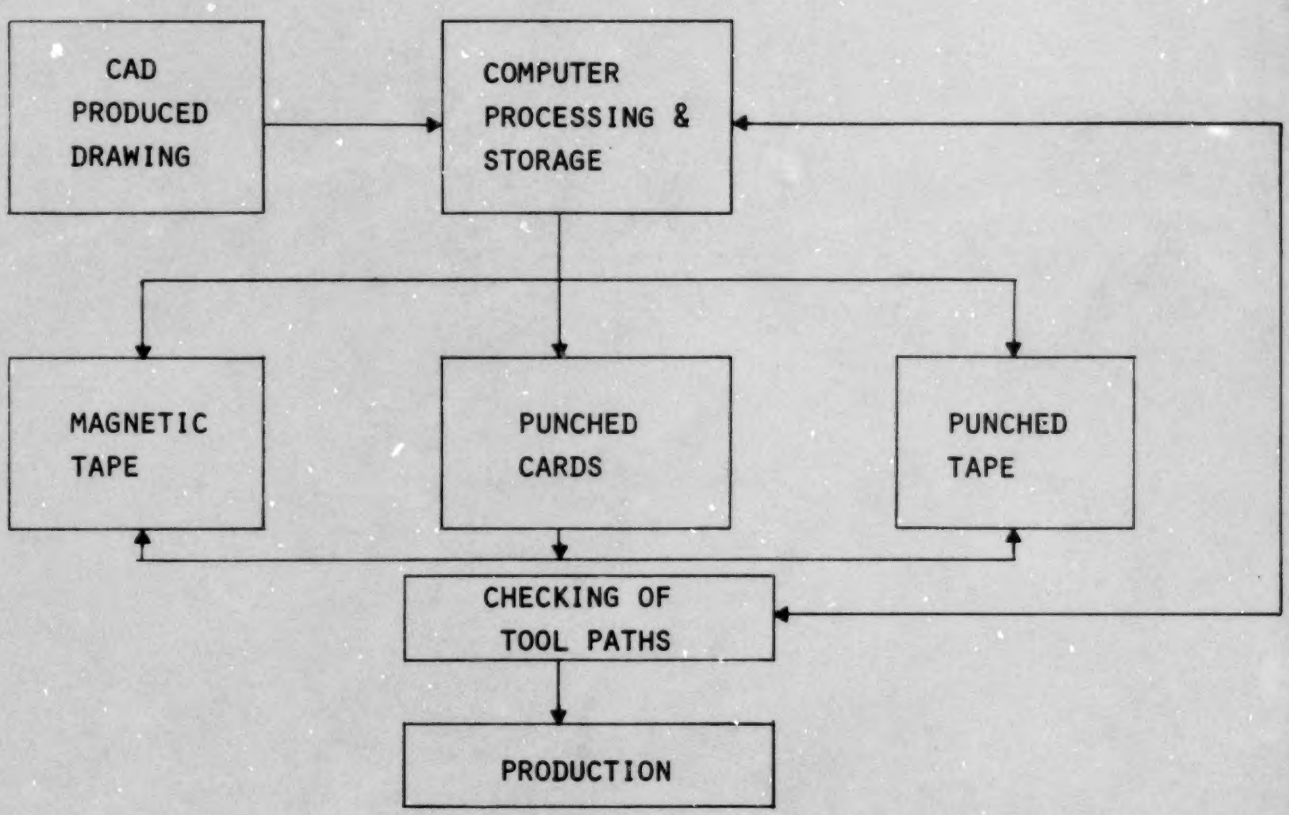
INTERMITTENT MANUFACTURING

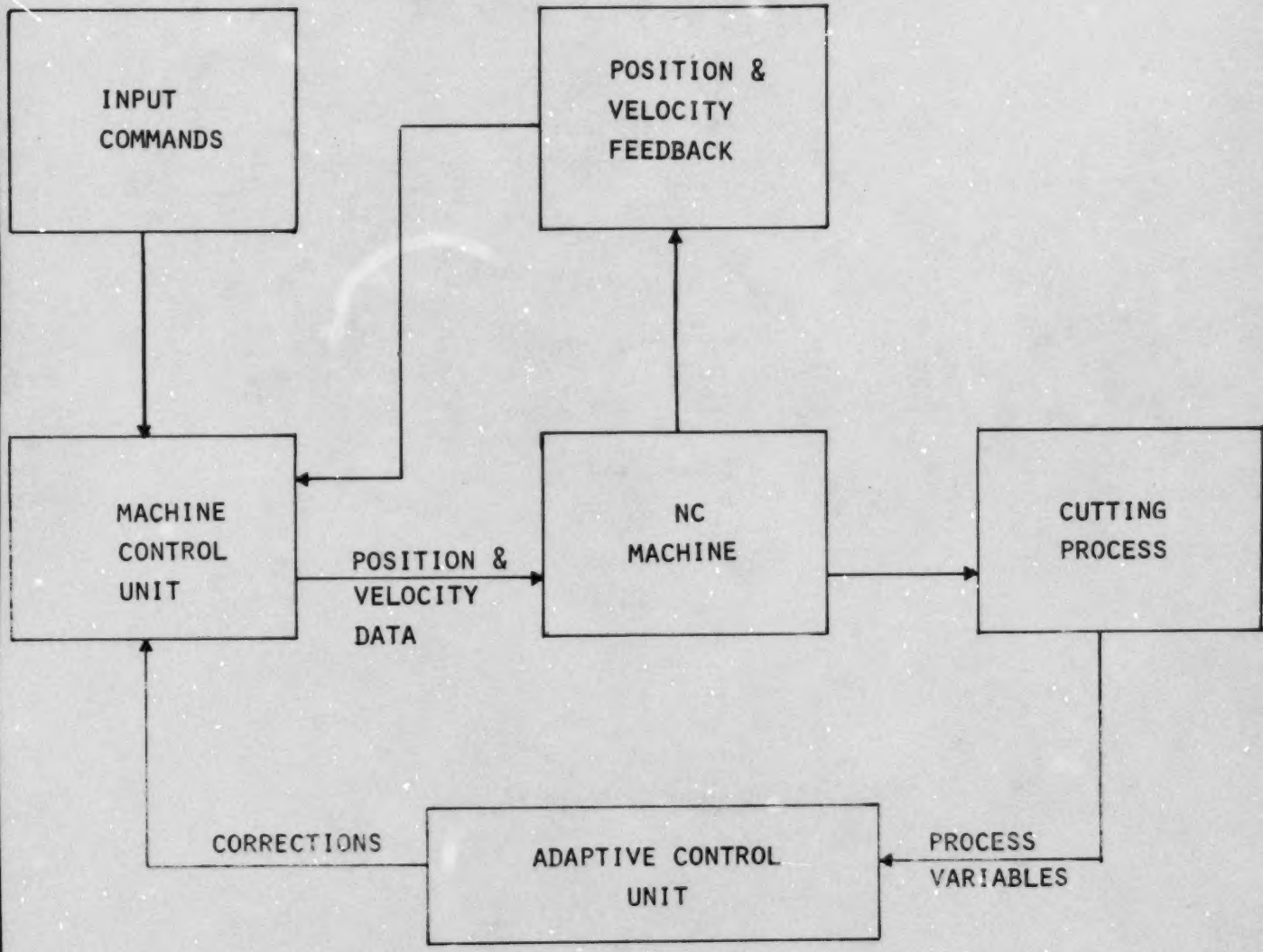
- BATCH PRODUCTION
- SUB-ASSEMBLIES

CONVENTIONAL NC SYSTEM

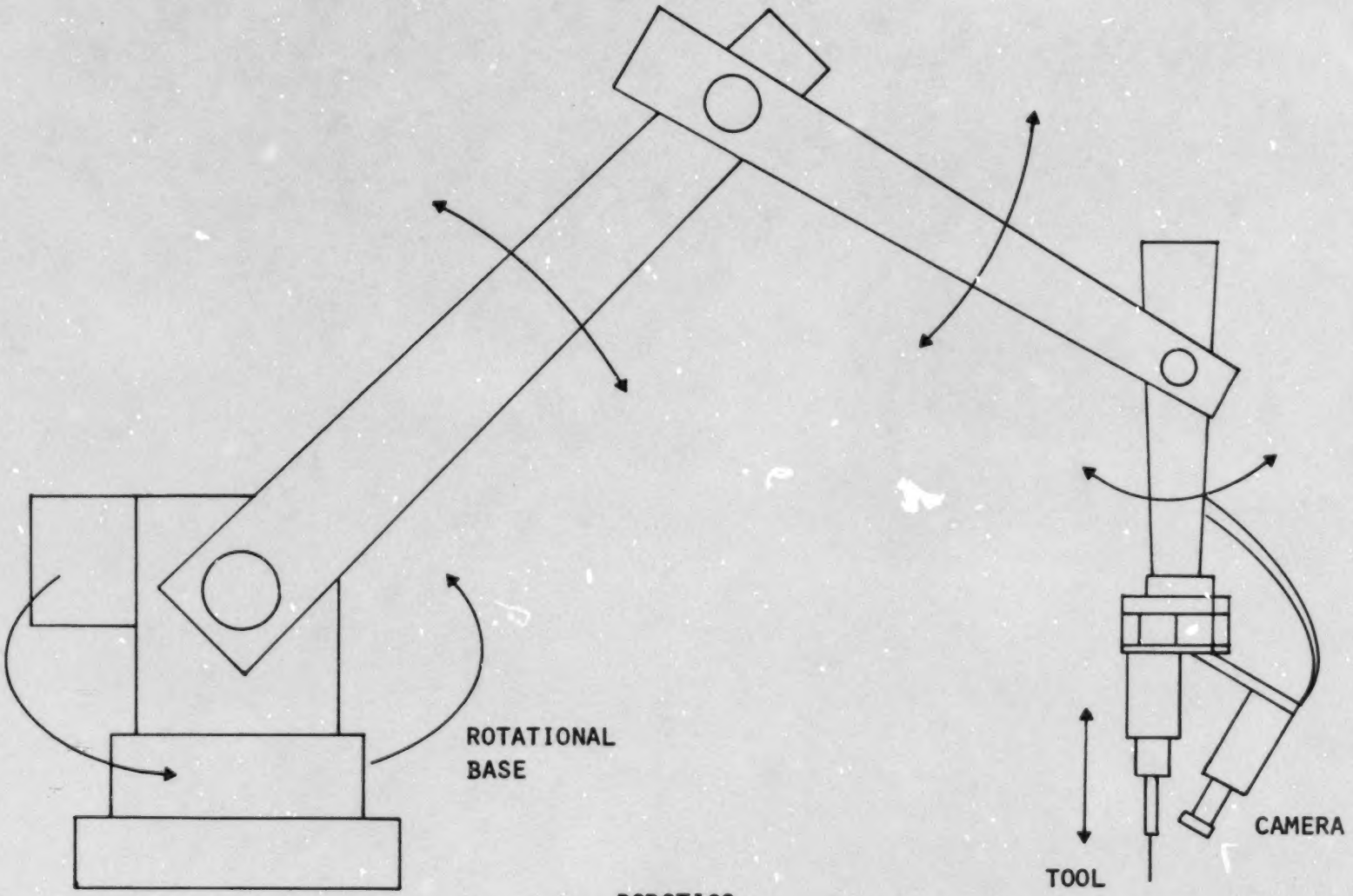


COMPUTER NUMERIC CONTROL SYSTEM




ADAPTIVE CONTROL SYSTEM
INPUT COMMANDS
POSITION & VELOCITY FEEDBACK
MACHINE CONTROL UNIT
POSITION & VELOCITY DATA
NC MACHINE
CUTTING PROCESS
CORRECTIONS
ADAPTIVE CONTROL UNIT
PROCESS VARIABLES

PLI-11



ROBOTICS

COMMON POLLUTION PROBLEMS

WASTE DISPOSAL SITES

POLLUTED LAKES AND STREAMS

- LOSS OF RECREATION
- ODORS
- FISH KILLS
- LOSS OF BUSINESS (FISHING, RECREATION, ETC.)

AIR POLLUTION

- AUTOMOBILES
- INDUSTRY
- AGRICULTURAL BURNING

CULMINATION OF RUBBISH

- DISEASE
- FLIES, RATS, ETC.
- UNSIGHTLY NEIGHBORHOODS
- REDUCED PROPERTY VALUES

INCREASED NOISE POLLUTION

- AIRPORTS
- INDUSTRY
- URBANIZATION

2

History and Development of Plastics

OBJECTIVES

After students have covered the material in this unit, they should be able to—

1. identify the first two plastics that were developed;
2. define the term **synthetic**;
3. identify the "Father of Plastics";
4. list three reasons why plastics are replacing many natural materials in industry;
5. identify new developments in plastics processing;
6. compare the qualities, advantages, and disadvantages of natural materials and synthetic materials; and
7. explain the use of computerized systems in the plastics industry.

KEY WORDS: VOCABULARY

The words in the following list may be new to the student studying plastics. Teachers should help students understand these words as they are used in the topic of study.

synthetic
natural materials
plastics
CNC equipment
robot
laser

TEACHING AIDS

- Overhead projector
- Films
- Filmstrips
- Slides
- Charts
- Some of the materials listed in Appendix A can be used as teaching aids when appropriate.
- Test Key: 1-B, 2-C, 3-A, 4-A, 5-D
- Transparencies: You will find transparencies PL2-1 through PL2-4 at the end of this unit. If you wish, these masters may be duplicated in quantity and given as handouts to the students while they are studying different aspects of this unit.

PL2-1: Production Materials
PL2-2: The Future of Plastics
PL2-3: Natural and Synthetic Materials
PL2-4: Qualities of Plastic

SUGGESTED REFERENCES

The references listed here represent only a few of those available. Other information can be obtained from the U.S. Government Printing Office, The Society of the Plastics Industry, The Society of Plastics Engineers, and The Plastics Education Foundation. Periodicals such as Plastics Technology, Plastics World, Plastics Engineering, Modern

Plastics, Modern Plastics Encyclopedia, and Plastics Design and Processing are excellent sources of information regarding all phases of the plastics industry. Trade publications are often available in classroom quantities free of charge. Many of these trade publications contain information that can be of great assistance to teachers and students. Educational publications, such as Industrial Education, School Shop, and Technology Teacher, provide up-to-date information about teaching techniques and aids that are available to the plastics teacher.

Baird, R. J., and Baird, D. T. Industrial Plastics. South Holland, Ill.: Goodheart-Willcox Company, 1982.

Edwards, Lauton. Industrial Arts Plastics. 2nd ed. Peoria, Ill.: Charles A. Bennett Company, 1974.

Jambro, D. J. Manufacturing Processes: Plastics. Englewood Cliffs, N.J.: Prentice-Hall, 1976.

Miller, W. R., et al. Basic Industrial Arts: Plastics. Bloomington, Ill.: McKnight Publishing Company, 1978.

Steele, G. L. Exploring the World of Plastics. Bloomington, Ill.: McKnight Publishing Company, 1977.

SENTENCE OUTLINE

I. History of plastics
   A. Plastics materials are not natural in origin but are made by humans from natural materials, such as petroleum products.
   B. These man-made materials are called **synthetic** materials. (Transparency PL2-1)
   C. Plastics materials are relatively new to industry and have been in use for just over 100 years.
      1. The first plastic material, called **celluloid,** was developed by John and I. S. Hyatt in 1868.
      2. Celluloid was developed as a substitute for ivory and has been used for movie film, buggy windows, and billiard balls.
      3. John Hyatt is often called the "Father of the Plastics Industry."
      4. The next plastic to be patented was developed as a synthetic electrical insulator.
      5. This plastic, called **Bakelite,** was discovered by Dr. Leo Baekeland in 1909.
      6. **Bakelite** is a phenolic resin used for distributor caps, insulators, and automobile ignition parts.
      7. The development of vinyls, polystyrene, and polyethylene followed the development of Bakelite and led to a large number of new materials and processes.

II. Development of the plastics industry
   A. Many plastics materials have been developed as substitutes for natural materials, while others were developed for specific purposes.
   B. New plastics materials and new uses for plastics are being developed at an almost unbelievable rate.
      1. During the past 50 years, the plastics industry has grown much faster than any other industry.
      2. More plastic products are produced at the present time than metal products.

III. Future use of plastics
   A. Many of the plastics materials and products we will take for granted during the next 50 years have not even been discovered yet.
   B. In the future, plastics will play an even more important role in our lives as plastics materials replace more and more natural materials in the effort to conserve natural resources.

C. New developments will require more emphasis on computerized equipment and processes, such as—
   1. computer-controlled mixing equipment;
   2. robots to handle hot plastic during forming, to place sheet plastic in molds, and to load granulated plastic into machines (Transparency PL2-2);
   3. CNC (computer numerical control) equipment used in machining dies, forming the plastic into products, and machining plastic stock; and
   4. lasers to machine intricate details into dies and plastic products.

IV. Applications of plastics
   A. Plastics materials are often used as substitutes for metal, wood, glass, leather, rubber, cloth fibers, hemp, and many other natural or common materials. (Transparency PL2-3)
   B. In many cases, plastics are far superior to natural and other synthetic materials.
      1. Plastics are lighter in weight and more corrosion-resistant than metal and wood. (Transparency PL2-4)
      2. Plastics are easier to form than metal and wood.
      3. Plastics are more durable than rubber.
      4. Plastics are more break- or shatter-resistant than glass and pottery and are lighter in weight.
      5. Clothing made with plastic fibers (polyester) is more wrinkle-resistant than cotton.
      6. Ropes made with plastic fibers are more resistant to wear and deterioration than ropes made with hemp.
      7. Plastics are easier to form, more durable, and more stain-resistant than leather.
      8. Plastics are more versatile than most other materials.
   C. Although plastics substitutes are available, many natural materials are preferred over plastic substitutes because they have qualities that cannot be duplicated in plastic.
      1. Plastic is more resistant to water than leather, but does not allow air to pass. This makes leather the preferred material for shoes.
      2. Plastic can be formed to look like a rose but does not have the texture or aroma.
      3. Plastic scratches more easily than glass.
      4. Plastic does not have the texture or beauty of wood.
      5. Plastic does not have the rigidity or strength of metal.
   D. Each material (natural and synthetic) has advantages and disadvantages over other materials.
   E. The qualities, advantages, and disadvantages of all available materials must be considered before a new design is put into production.

MATERIALS FOR STUDENTS

- Vocabulary worksheet
- Poster board or paper
- Marking pens

SUGGESTED STUDENT ACTIVITIES

1. Have each student develop a time line or chart that shows approximately when human beings started using industrial materials such as wood, metal, rubber, pottery clay, glass, leather, hemp, cotton, and plastic. A line marked with the approximate dates would help students realize that plastic is one of the newest industrial materials available.

2. Have each student make a list of plastic products used in their homes every day. A limit may need to be set because of the potential number of items. Have the students read their lists to the class.
3. Have student prepare a chart listing plastic materials found in their homes that serve as substitutes for natural materials. In one column, list the plastic material or product, and in the other column show the natural material that it replaces.

Vocabulary Worksheet

1. synthetic

2. natural materials

3. plastics

4. CNC equipment

5. robot

6. laser

TEST

Unit 2: History and Development of Plastics

Directions: Read each statement carefully. Select the word or phrase that correctly answers or completes the statement, and write the appropriate letter in the blank.

Example: __C__ 21. The class that you are in is—

A. American Government
B. Language Arts
C. Industrial Arts
D. General Science

___ 1. Plastic materials are classified as—

A. elements
B. synthetic materials
C. natural materials
D. polyquadrides

___ 2. The first plastic to be developed was used as a substitute for—

A. rubber
B. glass
C. ivory
D. metal

___ 3. The second plastic to be developed was used as an electrical insulator and is called—

A. Bakelite
B. celluloid
C. polystyrene
D. vinyl

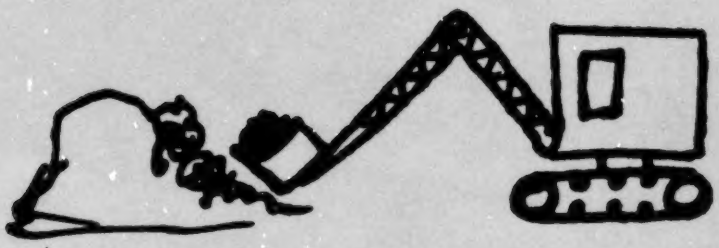
___ 4. The man who is considered to be the "Father of the Plastics Industry" is—

A. John Hyatt
B. Leo Baekeland
C. Eli Whitney
D. John Tewes

___ 5. Computers are used in the plastics industry to control—

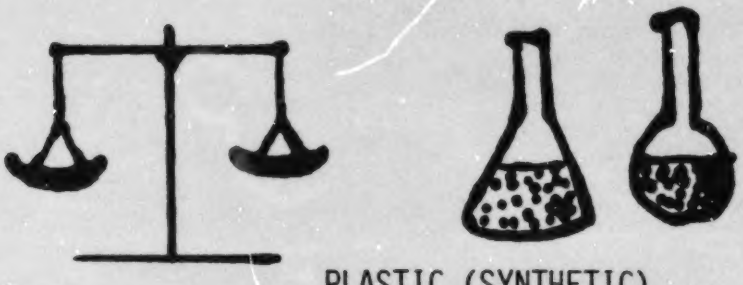
A. mixing equipment
B. machining equipment
C. material-handling equipment
D. all of the above

PRODUCTION MATERIALS



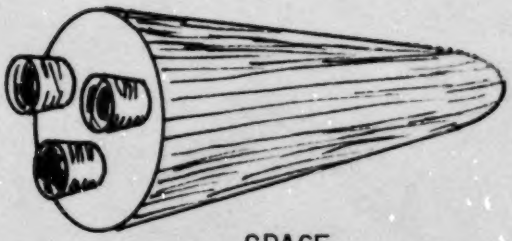
WOOD
(NATURAL)

METAL
(NATURAL)

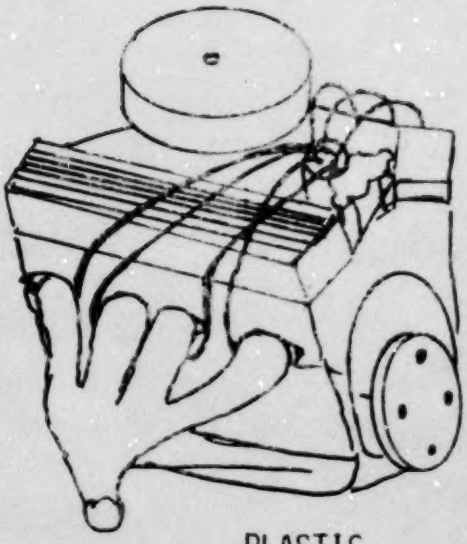


PLASTIC (SYNTHETIC)

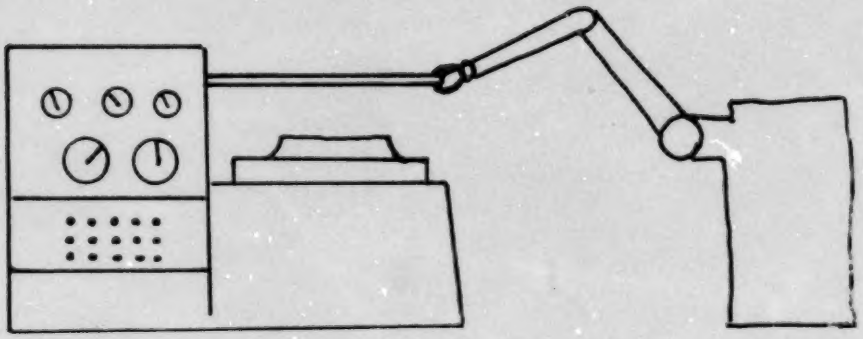
THE FUTURE OF PLASTICS



SPACE
CAPSULE



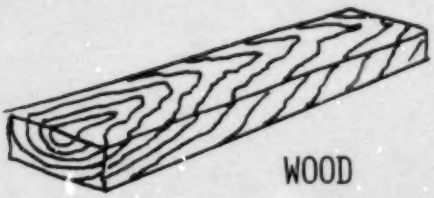
PLASTIC
ENGINE



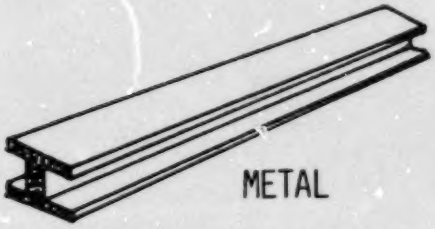
ROBOT OPERATED VACUUM FORMING
MACHINE

NATURAL AND SYNTHETIC MATERIALS

NATURAL



WOOD



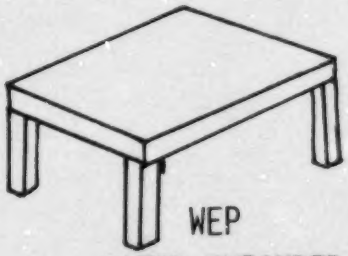
METAL

GLASS

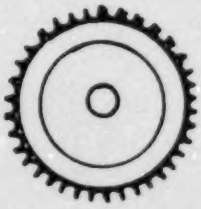
HEMP ROPE

LEATHER SHOE

PLASTICS



WEP
WATER-EXPANDED
POLYESTER



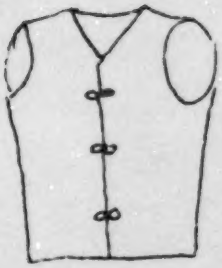
NYLON
GEARS

POLYPROPYLENE
TUMBLER

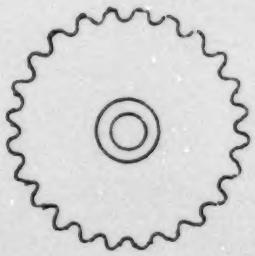
NYLON
ROPE

CORFAM SHOE

QUALITIES OF PLASTIC

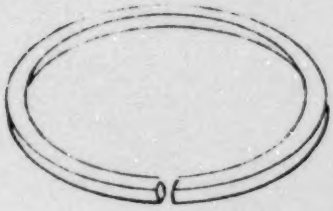


LIGHT WEIGHT

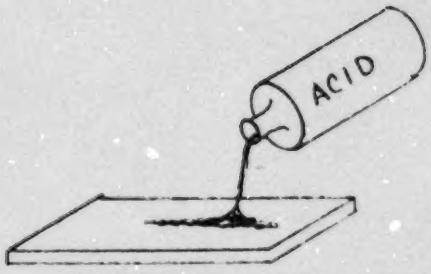


DURABLE

PLASTIC



VERSATILE



CORROSION RESISTANT

3
Safety

OBJECTIVES

After students have covered the material in this unit, they should be able to—

1. demonstrate the safe use and correct maintenance of hand tools used in working with plastic;
2. demonstrate the safe use and correct maintenance of machines in the plastics lab;
3. demonstrate safe methods of handling hot plastic;
4. demonstrate safe methods of handling caustic plastic materials; and
5. pass safety exams on each machine used in the plastics lab.

KEY WORDS: VOCABULARY

The words in the following list may be new to the student studying plastics. Teachers should help students understand these words as they are used in the topic of study.

resin
catalyst
solvents
safety glasses
safety zone
mold

TEACHING AIDS

- Overhead projector
- Films
- Filmstrips
- Slides
- Charts
- Some of the materials listed in Appendix A can be used as teaching aids when appropriate.
- Test Key: 1-D, 2-C, 3-D, 4-D, 5-D
- Transparencies: You will find transparencies PL3-1 through PL3-3 at the end of this unit. If you wish, these masters may be duplicated in quantity and given as handouts to the students while they are studying different aspects of this unit.

PL3-1: Safety (Materials)
PL3-2: Safety (Equipment)
PL3-3: Accident Prevention

SUGGESTED REFERENCES

The references listed here represent only a few of those available. Other information can be obtained from the U.S. Government Printing Office, The Society of the Plastics Industry, The Society of Plastics Engineers, and The Plastics Education Foundation. Periodicals such as Plastics Technology, Plastics World, Plastics Engineering, Modern Plastics, Modern Plastics Encyclopedia, and Plastics Design and Processing are excellent sources of information regarding all phases of the plastics industry. Trade publications are often available in classroom quantities, free of charge. Many of these trade

publications contain information that can be of great assistance to teachers and students. Educational publications, such as Industrial Education, School Shop, and Technology Teacher, provide up-to-date information about teaching techniques and aids that are available to the plastics teacher.

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SENTENCE OUTLINE

I. Material handling
   A. Many plastics materials must be heated before they can be molded or formed.
      1. Hot plastic materials must be handled with hot pads or asbestos gloves to prevent burns.
      2. Special care must be taken when working with melted plastic or heated resins to avoid spills or splashing. (Transparency PL3-1)
   B. Some plastic materials burn easily or explode if improperly mixed or exposed to flame or sparks.
      1. Keep catalysts and resins away from flame and sparks.
      2. Improper mixing of some resins and catalysts can cause explosions.
      3. A potentially explosive gas accumulates in closed containers of polystryrene beads. The gas should be allowed to escape in a well-ventilated area away from flames and sparks.
   C. Provide proper ventilation for working with raw plastics materials.
      1. Fumes from fiberglass resin can irritate eyes and skin.
      2. Avoid inhaling fumes from heated plastics.
      3. Materials such as polyurethane foams and polyester resins give off potentially dangerous fumes.
   D. Some solvents and chemicals used in testing and bonding plastics materials are very toxic and may cause burns or irritation when in contact with the skin or eyes.
   E. Gloves and masks must be worn when working with glass fibers and resins to prevent irritation.
   F. Resins, catalysts, and other chemicals used in the plastics industry should not be stored with food in order to avoid contaminating the food.
   G. A mask must be worn when sanding fiberglass on a machine sander.
   H. Safety glasses or goggles must be worn when cutting or sanding plastics on power equipment.
   I. Plastics materials sometimes develop sharp edges during the forming and cutting processes. Exercise care to prevent cuts.

II. Operating plastic forming equipment
   Note: Extreme caution must be observed when operating this equipment.
   A. In many forming operations, the forming machine heats the plastics material to a softened state.
      1. Guards, safety zones, and hot signs should be observed to avoid touching hot surfaces. (Transparency PL3-2)
      2. Care must also be exercised when removing plastic products from forming machines to avoid touching hot surfaces.

B. Some forming processes heat removable molds as the plastic is heated.
   1. Wear asbestos gloves when removing or handling hot molds.
   2. Avoid setting hot molds on wood or plastic surfaces that may be damaged by heat.

C. Many forming machines use high pressure to form the plastic. Use guards and signs to protect workers from moving parts.

III. Hand tools

A. Many plastics materials are cut and machined with the same tools used to cut wood and metal.
   1. Hand tools, such as saws, scrapers, files, and so forth, must be used properly and carefully to avoid injuries. Correct use of each tool should be demonstrated by the teacher.
   2. Dull and improperly maintained tools are dangerous.
   3. Hand tools should be inspected and sharpened on a routine schedule.
   4. Files should never be used without handles.

IV. Machine tools

A. Plastics materials can be cut by sawing, shearing, drilling, die cutting, hot wires, and so forth.
   1. Safe procedures for the operation of all power equipment used by students must be explained thoroughly and demonstrated by the teacher.
   2. Safety rules should be posted on each machine used by students.
   3. Safety glasses must be worn during any machine operation.
   4. Safety zones marked around the machines must be observed when the machines are in operation.
   5. Students should be required to perform at a designated level on safety exams covering each machine.

B. Although shears, hot wires, and die cutters may not be classified as machine tools, safety precautions must also be observed in these operations.
   1. Fingers must be kept away from blades when using shears, paper cutters, and so on.
   2. Depending upon the design, hot wires may present an electrical hazard as well as the danger of burns.

V. Maintenance of tools and equipment

A. Inadequate maintenance of machine tools and forming equipment produces a potential hazard.
   1. All machines should be inspected and serviced on a routine schedule. This should include lubrication and the tightening of bolts that may work loose during operation.
   2. All equipment should be cleaned of excess oil, grease, and debris at the end of each operation.

B. Blades and cutters must be kept sharp and in good operating condition to prevent injuries and damage to the equipment and products. (Transparency PL3-3)

C. Molds and dies must be kept clean and free of obstructions to ensure safe operation and prevent damage to the forming equipment.

D. In processes involving molten or softened plastic, operators must make sure the plastic is soft before operating the equipment.

MATERIALS FOR STUDENTS

- Vocabulary worksheet
- Poster board and paper
- Markers, pencils, pens, etc.
- Damaged tools
- Safety exams

SUGGESTED STUDENT ACTIVITIES

1. Have students make a safety poster illustrating the prevention of one of the following:
   a. burns
   b. cuts
   c. fires
   d. explosions
   e. inhalation of fumes
2. Show students examples of poorly maintained or abused tools, and have them explain how the tools got into that condition.
3. Administer safety exams to the students.
4. Establish one day in each month (the last class day of the month, for example) to have students conduct a comprehensive safety inspection of the lab. The inspection should include forming equipment, molds, dies, hand tools, and other factors affecting the safety of the students.
5. Have students develop a safety checklist for the operation of each machine to be posted near the machine.

Vocabulary Worksheet

1. resin

2. catalyst

3. solvents

4. safety glasses

5. safety zone

6. mold

TEST

Unit 3: Safety

Directions: Read each statement carefully. Select the word or phrase that correctly answers or completes the statement, and write the appropriate letter in the blank.

Example: C 21. The class that you are in is—

A. American Government
B. Language Arts
C. Industrial Arts
D. General Science

___ 1. Plastic materials must be handled very carefully to avoid injuries from—

A. explosions
B. burns
C. cuts
D. all of the above

___ 2. Good ventilation must be provided to prevent—

A. skin rashes
B. eye injuries
C. inhaling fumes
D. flying plastic particles

___ 3. Catalysts and resins must be mixed carefully to avoid—

A. explosions
B. fires
C. dangerous fumes
D. all of the above

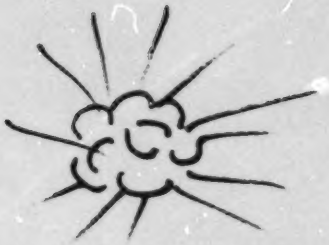
___ 4. To avoid injuries from cutting tools, the tools must be—

A. sharp
B. clean
C. in correct working condition
D. all of the above

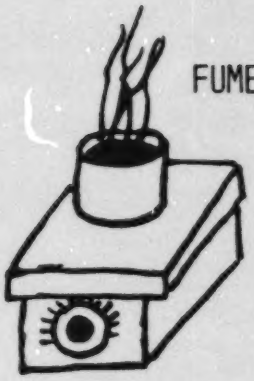
___ 5. Protection from hot surfaces on machines can be provided by—

A. safety glasses
B. lab aprons
C. cotton gloves
D. guards

FIRES



EXPLOSIONS



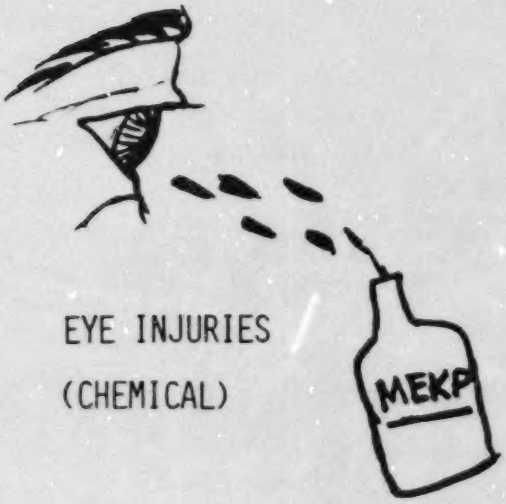
FUMES

BURNS

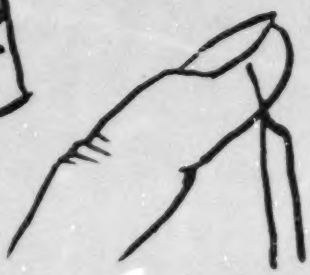
PLASTIC MATERIALS

HAZARDS

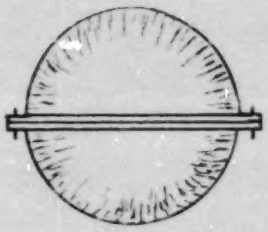
BURNS
(CHEMICAL)



EYE INJURIES
(CHEMICAL)

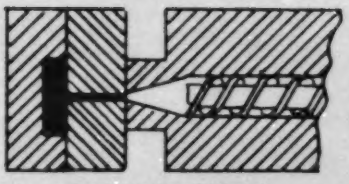


CUTS
(SHARP EDGES)



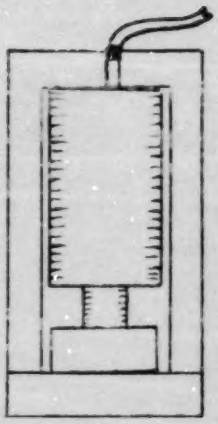
HOT MOLDS

(ROTATIONAL MOLDING)



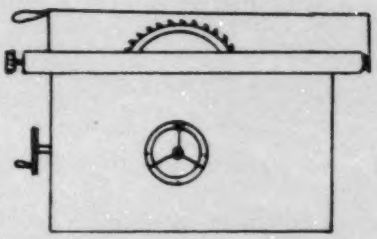
HOT SURFACES

(INJECTION RAM)



PRESSURE

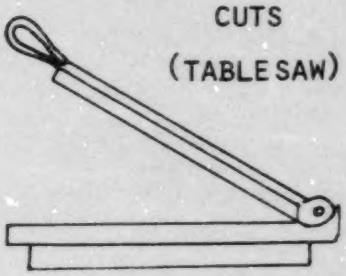
(COMPRESSION MOLDING)



CUTS

(TABLE SAW)

EQUIPMENT & TOOLS



CUTS

(SHEARS)

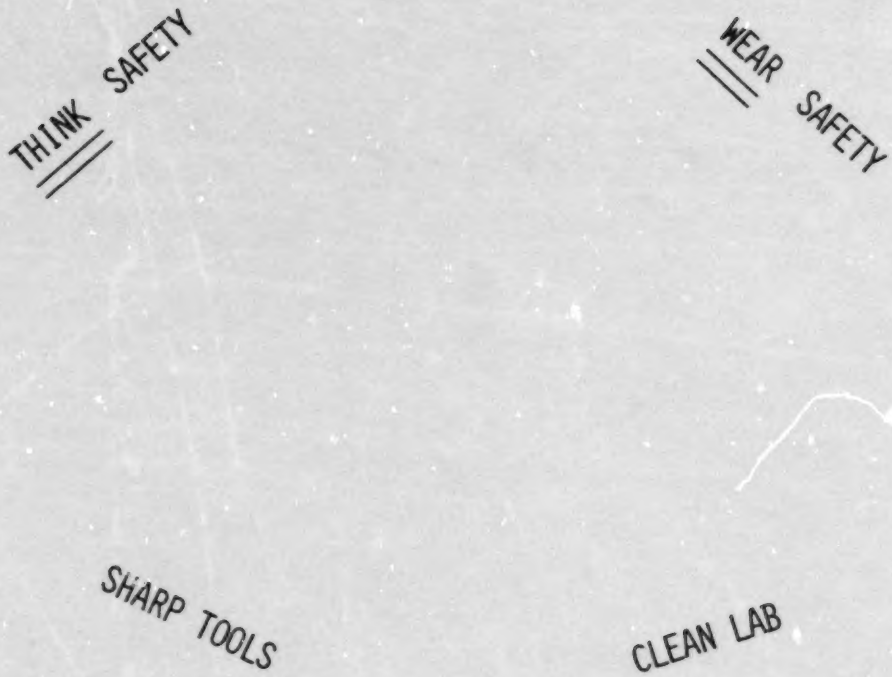
EYE INJURIES

(SAWING AND DRILLING)

PUNCTURE

WOUNDS

(UNPROTECTED FILE TANGS)



ACCIDENT PREVENTION

4

Youth Leadership, Entrepreneurship, and Laboratory Management

OBJECTIVES

After students have covered the material in this unit, they should be able to—

1. participate in organizing a personnel system, conducting a meeting, and using democratic decision-making procedures;
2. list industrial and community resources, select at least three appropriate to the unit of study, and arrange for a speaker or tour;
3. conduct a survey of industries or use a questionnaire during an interview with industrial career persons;
4. plan, organize, and carry out activities or projects that contribute to an improvement in, or service to, the school and/or community;
5. communicate with others to determine the need for a product or service;
6. organize and manage their own business to produce a product or render a service of economic value that will have sales appeal to students or adults;
7. organize, manage, and participate in contests, exhibits, or demonstrations that motivate students to learn and provide recognition for their achievements;
8. describe the fundamental differences between the three major economic systems of communism, socialism, and capitalism;
9. list several ways that individuals and companies can invest capital to make more money;
10. describe the free enterprise system as it relates to the industrial system in the United States;
11. describe an entrepreneur;
12. list three controls that regulate the free enterprise system;
13. explain the importance of an efficient management organization in industry;
14. complete an application form for a position of employment; and
15. identify and display the qualities employers look for in employees.

KEY WORDS: VOCABULARY

The words in the following list may be new to the student studying plastics. Teachers should help students understand these words as they are used in this topic of study.

personnel system
decision making
vendor
enterprise
organize
manage
technical
industrial and commercial resources
economy
communism
socialism
capitalism
capital
investment
profit
stocks
interest
competition
application form
interview
supervisor

TEACHING AIDS

- Overhead projector
- Films
- Filmstrips
- Slides
- Charts
- Some of the materials listed in Appendix A can be used as teaching aids when appropriate.
- Test Key: 1-A, 2-D, 3-C, 4-A, 5-B, 6-B, 7-D, 8-B, 9-C, 10-A, 11-D, 12-A, 13-D
- Transparencies: You will find transparencies PL4-1 through PL4-3 at the end of this unit. If you wish, these masters may be duplicated in quantity and given as handouts to the students while they are studying different aspects of this unit.

  PL4-1: Organizational System Industrial Corporation
  PL4-2: Organizational System Industrial Arts Laboratory
  PL4-3: Qualities of Good Employees

SUGGESTED REFERENCES

The references listed here represent only a few of those available. Other information can be obtained from the U.S. Government Printing Office, The Society of the Plastic Industry, The Society of Plastics Engineers, and The Plastics Education Foundation. Periodicals such as Plastics Technology, Plastics World, Plastics Engineering, Modern Plastics, Modern Plastics Encyclopedia, and Plastics Design and Processing are excellent sources of information regarding all phases of the plastics industry. Trade publications are often available in classroom quantities, free of charge. Many of these trade publications contain information that can be of great assistance of teachers and students. Educational publications, such as Industrial Education, School Shop, and Technology Teacher, provide up-to-date information about teaching techniques and aids that are available to the plastics teacher.

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SENTENCE OUTLINE

I. Youth leadership
   A. Using personnel/leadership development systems
      1. All organizations use systems to manage group activities.
      2. The duties of personnel who hold various positions in the system rely on the total group working together for the benefit of all in the organization.
      3. The personnel system is made up of officers and committees that are responsible for carrying out the duties and responsibilities of the organization.
      4. It is important for students to work together and to develop leadership skills.
      5. Democratic decision making is developed through the process of conducting meetings and learning how to make motions in those meetings.
   B. Using industrial community resources
      1. Making contacts with community and industrial leaders will help develop leadership skills.
      2. Part of leadership development is learning how to survey industry and to use a questionnaire during an interview.
      3. Community resources are an extension of the industrial arts classroom which allows students a more in-depth exposure to personnel/leadership development.
   C. Providing a school or community service
      1. Service or community projects provide benefits to others and to those who provide them.
      2. Service projects enable students to use their technical know-how to help others in the same way that inventions help solve problems.
   D. Enterprising a product or service
      1. In the United States, the industrial system is called free enterprise. This means that we are free to establish any kind of business and to make almost any product we desire.
      2. Through free enterprise, companies are encouraged to produce new products that are protected by patents.
      3. Products are sold for their economic value, and services are provided for their economic value.
   E. Recognizing student achievements
      1. AIASA contests and booth exhibits provide opportunities for students to develop leadership skills through competing and interacting with other students on the regional, state, and national levels.
      2. Through the various contests and exhibits, students will be recognized for outstanding individual and chapter work.

II. Entrepreneurship
   A. Introduction
      1. Three types of ownership
         a. Sole proprietorship refers to a single person owning a business.
         b. Partnership refers to several people owning a business together.
         c. A corporation exists when shares of stock are sold to individuals and these individuals act as one to operate the business.
      2. All companies are organized in a certain hierarchial structure, with various line and staff functions and responsibilities.
      3. Entrepreneurship involves the functions of planning, organizing, controlling, and directing workers and activities.
      4. It involves the feasibility of providing a product or service of high quality to the consumer at a fair price.
      5. Securing and training manufacturing workers for the business is a vital part of entrepreneurship.

6. Scheduling workers and routing materials for the job is a major responsibility to the overall success of the business. Seeing that the job is completed on time with good workmanship is another.

B. What is communism? (examples: Russia and China)
   1. This type of government is highly centralized with a small group of governmental leaders making major economic decisions for everyone.
   2. The government owns the means to production (such as land, raw materials, factories, stores, and transportation).
   3. Communism and socialism are basically the same, except politically. Communism may favor revolution and force to spread its beliefs, whereas socialism advocates peaceful political change.
   4. Entrepreneurships cannot exist in a highly centralized form of government where risk taking is discouraged.

C. What is socialism? (examples: Sweden and Denmark)
   1. Socialism is similar to communism in that the means of production are owned by the government, and a small group of leaders determine what, when, and how much to produce.
   2. Advocates of socialism believe in peacefully blending their belief into society.
   3. Most socialist states are mixed, allowing the coexistence of capitalism.
   4. Entrepreneurship can flourish in a mixed socialist and capitalist state, but cannot exist in a pure socialist country.

D. What is capitalism? (examples: United States and Canada)
   1. Capitalism is an economic system that stresses private economic decision making. It operates without the overall economic grand plan common to communist and socialist economic systems.
   2. Capitalism is based on **capital,** or the surplus money of a company or individual.
   3. Capital is **invested** by individuals or companies with the hope of making more money.
      a. An individual may invest capital in a bank that pays **interest,** or take more of a risk and invest it in **stocks** that provide capital to companies.
      b. A company may invest its capital in new machines and facilities to produce more, better, or new products in hopes of making a **profit** or more money from its capital.

E. The free enterprise system and entrepreneurs
   1. The industrial system in the United States is known as a free enterprise system, and individuals and companies are free to make nearly any product they wish.
   2. The free enterprise system encourages individuals and companies to become entrepreneurs.
   3. Entrepreneurs are risk takers who invest capital to produce products with the hope of making a profit.
   4. The free enterprise system is controlled by the laws of supply and demand, competition, and regulation.
      a. **Supply and demand.** When demand is high for a product, entrepreneurs are willing to invest capital to produce more of a product, but a high supply of a product discourages entrepreneurs from investing capital.
      b. **Competition.** This is also a characteristic of a free enterprise system. Competition allows for two or more companies to produce similar products and to compete in the marketplace for the consumer's dollar. The company that produces the best product at the lowest price usually makes the most profit.
      c. **Regulations.** These are set by the government and private agencies to control the type and specifications of a certain product. (Example: The Environmental Protection Agency (EPA) requires car makers to control the pollutants they emit into the environment, or the Food and Drug Administration (FDA) requires that new medicines placed on the market be safe.)

F. Becoming an entrepreneur
   1. An enterprise is any business that sells either products or services, or both, and is owned, managed, and controlled by one or more persons.
   2. All enterprises carry with it basic risks: There are no guarantees of success, of making a profit, or that you will avoid losing your investment.
   3. Private enterprise in America is a privilege of our economic system.
   4. Our entire business system is made up mostly of small, privately owned companies.
   5. Our marketing system and competition within the markets for products and services is the strength of America.
   6. Our system is efficient because competition forces individual owners to streamline, cut waste, improve products and their services, and place the consumer or customer at the top of the economic pile.
   7. Entrepreneurship lets you decide your own destiny.
   8. The entrepreneur's keys to success are how well you manage what you have and how well you plan.
   9. Entrepreneurship provides challenge and personal satisfaction.
   10. Satisfaction is knowing that you provide a valuable service to customers and make their lives better.

G. Dangers and pitfalls to avoid
   1. Owning and managing a business requires great personal sacrifice.
   2. Ownership requires serious responsibilities.

H. Guidelines for entrepreneurship
   1. Get the right kind of assistance.
      a. Seek literature, publications, periodicals, textbooks, and other resources that give advice and essential knowledge.
      b. Visit the Small Business Administration offices.
      c. Talk to a local banker.
      d. Practical experience can be gained by working in the kind of business you wish to operate.
   2. Prepare a plan.
      a. You need a business plan.
      b. You need a marketing plan.
      c. You need an operating (profit and loss) plan.
      d. You need an organization and staff plan.
      e. You need job descriptions and responsibilities assigned to functions.
   3. Get the financial assistance you need before you start.
      a. You need a good credit rating.
      b. You must know what you want to do.
      c. You must have a good plan.
      d. You must demonstrate good management and financial responsibilities.
      e. There should be a good balance between personal assets and borrowing funds.
   4. Get professional marketing assistance.
      a. A competent commercial real estate agent can help you choose a good location, lease a building, buy an existing business, or perhaps develop a new business in a new location.
      b. You need an expert accountant to help you plan your finances, maintain your records, set up the right kinds of ledgers and accounts, interest rates, equipment purchases, employee records, tax reporting, and business planning.
      c. You need a competent attorney to help you plan the legal forms of ownership of your business, negotiate contracts, and leases, get the right kinds of licenses and permits, and decide the types of liabilities you should assume.

d. You need the help of the local chamber of commerce or merchants association.
e. You need to join a professional trade association.

II. Planning your business
1. Financial planning
The Bank of America suggests that an entrepreneur begin by asking four questions:
a. What do I need the money for?
b. How much money do I need?
c. How and when can I repay the money borrowed?
d. Can I afford to borrow money at this time?
2. Business plan
A good plan has seven parts:
a. description
b. market analysis
c. product and service description
d. sources of supply
e. marketing plan
f. management plan
g. financial forms

III. Laboratory management
A. All successful industrial corporations operate within efficient organizational systems.
1. A good organizational system is necessary to make sure all tasks are performed with minimal loss of time, money, and materials.
2. Efficient organization increases productivity and profit.
B. In large corporations, authority and responsibility are delegated by the board of directors to the president, vice-presidents, managers, and supervisors. (Transparency PL4-1)
C. Many management systems are used in industry. The line system is the most common.
D. Industrial arts laboratories can also benefit from the use of an efficient management system. (Transparency PL4-2)
E. The development of an efficient laboratory system involves—
1. a determination of all tasks to be performed on a regular schedule—daily, weekly, monthly, yearly;
2. a determination of who should perform the tasks—teacher, students, maintenance personnel, custodial staff;
3. a determination of how many students are needed to perform each task quickly and efficiently;
4. the development of a system for rotating the tasks from student to student periodically;
5. The development of an incentive plan to stimulate the students to perform the assigned tasks quickly, efficiently, and as well as possible; and
6. the selection of reliable and qualified students to fill the positions of supervisor and assistant supervisor.
F. Most people work better if they know they will be rewarded for work well done.
G. Common rewards used in industry include—
1. an increase in wages;
2. a promotion to a position of higher authority; and
3. bonus time off from their duties.
H. Most industries use an employee selection process that includes—
1. the completion of an application form; and
2. a personal interview with the prospective employee.

I. During an interview for a prospective position, an applicant can improve the chances for employment by—
   1. being well dressed and well groomed;
   2. being well prepared with intelligent questions about the responsibilities and duties associated with the position;
   3. having knowledge about the company, its products, and its operation; and
   4. displaying the qualities employers look for, such as self-confidence, ambition, courtesy toward others, willingness to assume responsibilities, honesty, and the ability to follow instructions and work with people. (Transparency PL4-3)

MATERIALS FOR STUDENTS

- Vocabulary worksheet
- Student Handout No. 1: The Student Association as Personnel System with Uniform Titles
- Student Handout No. 2: AIASA Personnel In-Class Duties
- Student Handout No. 3: Committee Duties
- Student Handout No. 4: Organizational Structure
- Student Handout No. 5: In-Class Meeting Procedures
- Student Handout No. 6: How Motions Are Made
- Student Handout No. 7: Duties for In-Class Use of Community Resources
- Student Handout No. 8: Duties for In-Class Service Projects
- Student Handout No. 9: Duties for In-Class Enterprising Products
- Student Handout No. 10: Duties for In-Class Contests and Recognition
- Student Handout No. 11: Regional, State, and National Recognition Events for Industrial Arts Students
- Student Handout No. 12: Calendar of Activities
- Business section of the newspaper that lists the stock market quotations
- Application form for supervisor's position
- Sample application forms
- Interview schedule
- Paper, pencils, pens, etc.

SUGGESTED STUDENTS ACTIVITIES

1. Students will participate in a discussion of the various positions in the Personnel/Leadership System. After election to an office or committee position, they will practice the duties. Their duties will help them conduct class meetings and manage laboratory activities. During class meetings, the students will use parliamentary procedures to make democratic decisions. These experiences help all students learn how meetings are conducted by AIASA and other groups.
2. All students will study the handouts describing the personnel system used in the class.
3. A nominating committee will be formed to work with the teacher and prepare the ballot.
4. Students elected to office or committee positions will study the duties and learn how to conduct a meeting.
5. Parliamentary procedures will be learned so that motions are used by all students.
6. Class officers will conduct a meeting to decide which industrial and community resources will be used to learn a certain unit of industrial arts. A community resources committee meets to list and select appropriate speakers or industrial tours. The class will vote on the best resource. With help from the teacher and the principal, the speaker is called, or a letter is written. If all students are not permitted to visit the industry, the committee may visit, videotape the industry, and report to the class. Afterwards, a "thank you" letter should be written to the persons who assisted the class or committee.

7. **Class officers:** Conduct a class meeting wherein your teacher will give a lesson on **Using Community Resources.** The historian serves on the committee. After the committee selects appropriate resources, the officers will conduct a meeting to select one. The officers will announce when the next class meeting will be held to allow time for this activity.
8. **Committee member:** (1) Use the library, chamber of commerce directories, or Yellow Pages to find an industry or business related to the unit of study. (2) After the class votes on the best resource, the committee writes a letter to invite a speaker or arrange a tour. (3) The parliamentarian obtains the permission forms from the principal's office if required. (4) A follow-up is made to check on the arrangements. (5) If the class is not permitted to visit the industry, the committee may visit and videotape the tour for the class. (6) A "thank you" letter is written to the speaker or industry. (7) Records are kept in a file for use by other classes or school chapters.
9. The class officers will conduct a class meeting to decide which service project will be provided by the class to help the school or community. A service committee will organize the project and involve class members in the laboratory work to complete the project for delivery or pickup.
10. The class officers will conduct a meeting to decide which product or service will be of economic value to the class or AIASA. The class will work as a group to form the enterprise. An enterprise committee will organize the technical and financial details for the class members. The entire class will work to make a profit for the class or to pay for AIASA dues or other activities.
11. The class officers will conduct a meeting to decide which contests will provide recognition for student achievements. The recognition committee will organize contests, exhibits, or demonstrations for the class. The class members will compete with each other or work together on a recognition event, such as an open house.
12. Select particular stocks from the newspaper, and follow their activity for a month. Determine if a profit or loss has been made.
13. Research the three economic systems of communism, socialism, and capitalism further.
14. Discuss the differences between communism, socialism, and capitalism.
15. Identify and discuss all the tasks in the laboratory that need to be performed on a regular basis (daily, weekly, or monthly) that can be performed by students.
16. Complete an application form for the position of supervisor. Include qualifications for the position and reasons for seeking the position.
17. Have the teacher interview you for the position of supervisor. Attempt to convince the teacher that you are the most capable person to fill the position.
18. Construct a mock-up of a time clock or some other suitable system to facilitate the checking of roll at the beginning of lab and the completion of all assigned tasks at the end of lab.
19. Identify and discuss incentives or rewards to motivate you and your fellow students to complete your assigned tasks, such as having one group on vacation through each rotation, added vacation time as a bonus for work well done, promotions, and so forth.
20. Complete the sample application forms found at the end of this unit. Discuss the information that is requested, and list the reasons you believe the employer has for wanting each piece of information.
21. Have students build a product of their choice. This product may fulfill a personal need, be for a family member, and be sold to someone in the community. Students should show a profit for their efforts. Compare this type of enterprise with that in Activity 10.
22. Have a real estate agent, an accountant, and a banker serve on a panel to discuss with the class business and financial planning. This should be done through an AIASA activity.

Vocabulary Worksheet

1. personnel system
2. decision making
3. vendor
4. enterprise
5. organize
6. manage
7. technical
8. industrial and commercial resources
9. economy
10. communism
11. socialism
12. capitalism
13. capital

14. investment

15. profit

16. stocks

17. interest

18. competition

19. application form

20. interview

21. supervisor

TEST

Unit 4: Youth Leadership, Entrepreneurship, and Laboratory Management

Directions: Read each statement carefully. Select the word or phrase that correctly answers or completes the statement, and write the appropriate letter in the blank.

Example: __C__ 21. The class that you are in is—

A. American Government
B. Language Arts
C. Industrial Arts
D. General Science

___ 1. A corporation can protect its products from being copied by—

A. patents
B. securing the design
C. securing the fixtures
D. none of the above

___ 2. Leadership skills can be developed by—

A. participating in contests
B. participating in class meetings
C. becoming an officer in student organizations
D. all of the above

___ 3. What type of economy has an overall grand plan for what will be produced and who owns the means of production?

A. capitalism
B. idealism
C. communism
D. all of the above

___ 4. What economic system, due to its lack of government control, strongly encourages entrepreneurship?

A. capitalism
B. socialism
C. communism
D. all of the above

___ 5. Capital is—

A. money needed for basic survival needs of food, shelter, or clothing
B. surplus money an individual or company can use to invest
C. money invested in a savings account
D. money invested in a retirement fund

___ 6. An entrepreneur—

A. can do well in a communistic country
B. is a risk taker
C. both of the above
D. does not need to make profits

___ 7. What controls determine what will be produced in a free enterprise system?

A. supply and demand
B. competition
C. government
D. all of the above

___ 8. What is stock?

A. money put into a savings account
B. money invested in a company
C. money needed for basic survival needs of food, shelter, or clothing
D. surplus money an individual can use to invest

___ 9. To make sure that all tasks are performed with minimal loss of time, money, and materials, industries rely on a good—

A. product record
B. employee relationship
C. organizational system
D. president

___ 10. The management system used most often in industry is the—

A. line system
B. pyramid system
C. task system
D. delegated system

___ 11. Incentives for industrial employees to work better at their jobs may take the form of—

A. higher pay
B. a promotion
C. time off with pay
D. all of the above

___ 12. The first step in the employee selection process in most cases is the—

A. application form
B. interview
C. skill level
D. personality evaluation

___ 13. One of the qualities that employers look for in prospective employees is—

A. ambition
B. self-confidence
C. ability to follow instructions
D. all of the above

STUDENT HANDOUT NO. 1

The Student Association as Personnel System with Uniform Titles

All Industrial Arts courses benefit from a personnel system used to manage the classroom or laboratory activities of students. Personnel management is a function of any organization whether it be a class of students, corporation of employees or an association of volunteers. Most Industrial Arts personnel systems differ as to the titles of each position in the system. Using AIASA related titles in the personnel system will both manage the class, as well as, give students experience with a group organization.

Officers in a democratic organization are best selected by the members of the group. Thus, the teacher may ask the class to nominate persons for election as key management officers. Teachers using any of the titles on the left are encouraged to utilize the uniform title in the right column.

Current Title		Should Have This Uniform Title
General Manager Lab Supervisor Superintendent Project Director	_____	PRESIDENT
Manager's Assistant Assistant Supervisor Co Director Production Manager	_____	VICE PRESIDENT
Roll Keeper Recordkeeper Letterwriter	_____	SECRETARY
Accountant Purchasing Agent Supply Clerk Bookkeeper	_____	TREASURER
Safety Director Attorney or Lawyer Contract Officer Permission Coordinator Inspector	_____	PARLIAMENTARIAN
Clean up Supervisor	_____	SERGEANT-AT-ARMS
Public Relations Director Advertising Agent Publicity Director	_____	REPORTER
Education Director Final Report Writer Scrapbook Manager Librarian	_____	HISTORIAN

STUDENT HANDOUT NO. 2

AIASA PERSONNEL IN-CLASS DUTIES

PRESIDENT (Students Name)

1. Leader of personnel system.
2. Calls clean-up.
3. Conducts class meetings.
4. Receives ideas and reports from the class members.
5. Suggests any possible lab improvements gained through experience.
6. Responsible for the assignment or election of new personnel.

VICE PRESIDENT (STUDENTS NAME)

1. Familiar with duties of President.
2. Substitutes for President.
3. Assists President as second level manager.
4. Helps follow-up committee work.
5. Helps other officers if absent or behind.
6. Makes organizational chart for class.

SECRETARY

1. Takes roll, makes slip of those absent for teacher.
2. Keeps Minutes of class decisions for reading at next meeting.
3. Records list of officers and committee personnel.
4. Prepares agenda for seminar or class meetings.
5. Sends letters when necessary.

TREASURER

1. Collects routine fees or AIASA dues.
2. Checks names of students who pay and writes receipt.
3. Charge students for use of supplies.
4. Helps teacher order supplies.
5. Cleans supply room.
6. Reports progresses of supply payment or purchases at meetings.
7. Serves on Enterprising Committee of class.

PARLIAMENTARIAN

1. Is responsible for general safety procedures.
2. Posts safety posters and information.
3. Files safety test records.
4. Inventories first aid supplies and notifies instructor when additional supplies are needed.
5. Reports any injuries to the instructor.
6. Helps President with motions and rules of class.
7. Serves on School/Community Service Committee of class.

SERGEANT AT ARMS

1. Oversees all clean-up personnel.
2. Makes substitutions for absent clean-up personnel.
3. Improvises and receives ideas for improving clean-up.
4. Reports to President and teacher when the clean-up is completed.
5. Prepares room for class meetings.
6. May serve as Quality Control or Union Steward.

REPORTER

1. Reports to class on the progress of activities.
2. Prepares bulletin board or displays related to class activities or school AIASA.
3. Writes articles or makes photos for school newspaper.
4. Welcomes visitors and explains classwork.
5. Cleans darkroom if available.
6. Advertises projects or services of class.
7. Serves on Recognition Committee of class.

HISTORIAN

1. Picks up homework or assignments for teacher.
2. Checks off work turned in by class members.
3. Assembles group reports.
4. Keeps notebooks, files or scrapbook up-to-date.
5. Cleans books and reference area of class during cloud.
6. Photographs activities.
7. Serves on Industrial Resource Committee of classes.

STUDENT HANDOUT NO. 3

COMMITTEE DUTIES

LABORATORY MAINTENANCE/ CLEANUP COMMITTEE

1. Sgt. at arms and officers appoint or rotate personnel to each position.
2. All students in class have duties or either as leader or worker in one of these areas:
   (1) Supplies and reference materials
   (2) Tools, equipment and machines
   (3) Auxiliary Rooms
   (4) Others (determined by teacher)
3. Workers report completion of duties to chairperson, leader, or sgt. at arms.
4. President, Sgt. at arms or teacher dismisses class at proper time.

INDUSTRIAL/COMMUNITY RESOURCE COMMITTEE

1. Make list of industrial or community resources related to course.
2. With teacher, select 3 helpful to unit of study.
3. Report resources available at class meetings for vote.
4. Arrange speakers or visits for class.
5. Send thank you letters.

SCHOOL/COMMUNITY SERVICE COMMITTEE

1. Make list of classroom, school or community service projects related to course.
2. With teacher, select 3 related to technical unit of study.
3. Review requests from others for services.
4. Report possible projects at class meetings for vote.
5. Organize class for work to be done.
6. Deliver service to appropriate person or group.

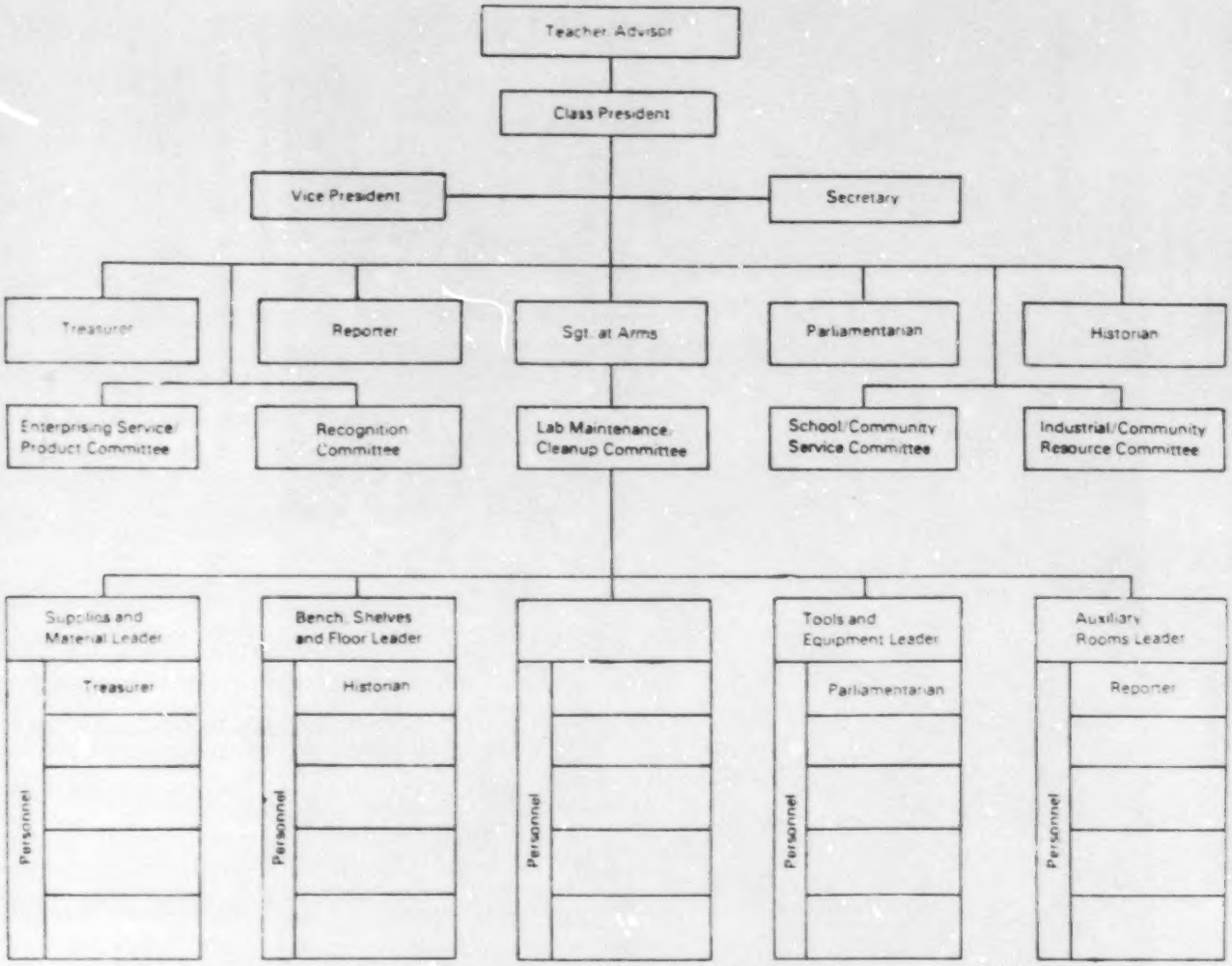
ENTERPRISING SERVICE OR PRODUCT COMMITTEE

1. Make list of products or services of economic value related to course.
2. Make prototypes of those related to unit of study.
3. Report possible products or services to class meetings for vote.
4. Organize company for production or service enterprise.
5. Keep financial records and report to class.
6. Present income for AIASA purpose to Treasurer.

RECOGNITION OF ACHIEVEMENT COMMITTEE

1. Make list of regular AIASA contests and others related to course.
2. With teacher, select or develop contests related to unit of study.
3. Report at class meetings on contests to be used.
4. Organize contest procedures and awards to be given.
5. Recognize winners with awards and newspaper articles.

ORGANIZATIONAL STRUCTURE



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STUDENT HANDOUT NO. 5

In-Class Meeting Procedures

Many of the routine activities of an industrial arts class can be handled by the officers of the class's student association. The **Class Meeting Agenda** should be in front of the students as poster to help each student understand meeting procedures.

1. Call to Order

President:	Raps gavel twice before saying: **Will the (class or meeting) please come to order? Sergeant At Arms, are there enough members present and in their seats to have a meeting?**
Sgt. at Arms:	**There are, (Mr. or Miss) President.** Tells students who arrive late to see Secretary for roll check.

2. Hear the Minutes of the Previous Meeting

President:	**We are ready to transact our business. Will the Secretary please read the Minutes?**
Secretary:	The Secretary stands and reads the Minutes which include date, time and place motions and other details of the last meeting.
President:	After the reading of the Minutes asks: **Are there any corrections or additions to the Minutes? (If none, the Minutes stand approved as read, or the Minutes stand approved as corrected.)**

3. Hear Reports of Officers or Standing Committees

President:	**The Assembly will hear reports of Officers.** (After each report, may ask; **You have heard the report. What is your pleasure?** For approval or adoption by motion?
Treasurer:	**The following amounts have been paid as (fees or dues) to the Treasurer $ _____.** The amount of $ _____ has been paid out. The total balance is $_____. The Treasurer may announce any fees to be paid or information about supplies.
Historian:	(May call for homework or assignments as part of group effort.)
Sgt. at Arms:	(May report on clean-up changes and condition of classroom and laboratories.)
Parliamentarian:	(May report or advise on procedures used for meeting or laboratory safety.)
Secretary:	(May report attendance information and give list of absent students to teacher.)
President:	**Do any Committees have reports?**
Maintenance Comm:	May report or advise.
Service Committee:	May report or advise.
Enterprising Comm:	May report or advise.
Resources Comm:	May report or advise.
Recognition Comm:	May report or advise.
President:	After each report say, **You have heard the report. What is your pleasure?**

4. Hear Reports of Special Committees

President:	**We will hear the report of the special committee for _____.**
Special Comm:	May report or advise.
President:	**You have heard the report. What is your pleasure?**

5. Hear Announcements

President:	**Are there any announcements to be made at this time?**
Reporter:	May report on class progress or outside events of interest to class or school AIASA.
Open to the Floor:	Other students may announce any meetings, activities or events scheduled in the future.
Teacher:	May wish to make announcements also.

6. Unfinished Business

President:	**The floor is open for discussion of unfinished business of the last meeting.**
Secretary or Parliamentarian:	May call attention to tabled motions or details from minutes of previous meetings.
Historian:	May remind members of homework or reports assigned or collect papers for teacher.

7. New Business

President:	**The floor is open for discussion of new business.**
Open to the Floor:	Suggestions for action not discussed before at the meeting would be introduced.
President:	(When the President feels that the discussion is complete, ask:) **Does anyone desire to make a motion?** (President acts on motion, appoints a committee or calls for another new business, or may call on the teacher (Mr., Miss, Mrs. _____, do we have a lesson?)
Teacher:	Presents lesson or announces laboratory work.

8. Adjournment of the Meeting

President:	Raps gavel twice. **If there is not further business, the meeting stands ready to adjourn.** Raps gavel 3 times. **What is our motto?**
All:	**"Learning to Live in a Technical World."**
President:	**Does anyone wish to introduce a motion to adjourn?** (Conduct vote on motion and declare adjournment) or say, Does anyone know of any reason why this assembly should not adjourn? **I declare this meeting adjourned.**

STUDENT HANDOUT NO. 6

HOW MOTIONS ARE MADE

HOW TO PRESENT A MOTION

There are eight simple steps in presenting a main motion:

1. The member rises and addresses the President.
2. The member is recognized by the President.
3. The member states his idea as a motion.
4. Another member seconds the motion.
5. The motion is restated by the President.
6. The Presidents conducts the discussion.
7. The President puts the question to a vote.
8. The President announces the result.

The main motion forms the starting point for any action to be taken by the group. Informal discussion may be allowed in small groups, but to be considered, the motion must be made, seconded, and stated by the President.

The President should know the exact moment at which to stop any informal discussion. He may bring things to a head by saying:

"If definite action is sought in this matter, a motion is in order."

This is how a motion is made:

1. Stand and address the President: **"Mr. or Ms. President."** Wait until you are recognized by the President. Do not speak until you are recognized by a nod or by name.

2. Be sure you have your motion clearly in mind, and worded as briefly as possible. Write it out if you can.

3. When you have been recognized, state the motion so that all can hear: **"I move that this chapter give a rising vote of thanks to its sponsor, Mr. Gardner."**

4. After the motion has been made, another member, without waiting to be recognized, calls out: **"I second the motion."**

5. The motion having been made and seconded, the President states the motion by saying: **"It has been moved and seconded that this chapter give a rising vote of thanks to its sponsor, Mr. Gardner."**

6. When the chairman has stated the motion, it is said to be pending. It may now be considered by the group -- that is, it is open to discussion and debate.

7. Any member may now rise to agree or disagree with the proposal. For example, a member may rise and say: **"Mr. or Ms. President."** The President says: **"Ron,"** so giving him permission to speak. **"I agree with the motion. Mr. Gardner has given his time to us and we should express our gratitude to him."**

8. The President inquires: **"Is there any further discussion?"** Since no one rises to discuss the motion further, the President asks, **"Are you ready for the question?"** (The "question" is the vote.) The members call out, **"Question?"**

9. The President then puts the question -- that is, he takes the vote. He or she says: **"It has been moved and seconded that this chapter give a rising vote of thanks to its sponsor, Mr. Gardner. All those in favor of the motion say 'Aye.'"**
   The members in favor of the motion say, **"Aye."**
   The President then says: **"Those opposed, say 'No.'"**

10. The President then announces the vote: **"The Ayes have it. The motion is carried."** Or, **"The Noes have it. The motion is defeated."**

STUDENT HANDOUT NO. 7

KINDS OF MOTIONS

There are four kinds of motions:

1. Privileged motion
2. Subsidiary motion
3. Incidental motion
4. Main motion

Motions that concern the rights and privileges of members are called privileged motions. Because of their urgency and importance, they come before all other motions. The most common privileged motions are:

1. To fix time and place for adjournment
2. To adjourn
3. To take a recess
4. Matters of personal privilege
5. Orders of the day

You will notice that four of these motions concern general rights. They are rights reserved to the chapter: when to adjourn, when to recess and when to insist that the rules be followed. The other motion, the motion of privilege, is the most important. It refers to a member's individual and personal rights.

Let us take an example of how this motion actually works.

Whenever there is any disturbance to the assembly, such as noise, presence of non-members, quarrels between members, or unpleasant atmospheric conditions, like excessive heat or cold, you may rise to a question of privilege. Suppose there is so much noise that you cannot hear. You might stand, and without waiting to be recognized, say: "**Mr. or Ms. President, I rise to a point of personal privilege.**"

The President would then tell you to state your point of privilege. You might say, "**There is too much noise. I can't hear.**"

Motions of personal privilege require no second, and are immediately decided by the President. In this case, he/she might direct the speaker to talk more loudly or he might take some other measure, such as closing the windows to shut out the disturbance. Business would then be resumed.

Subsidiary motions amend or otherwise dispose of other motions. There are seven of them. The two you may want to use, however, are (1) to refer to a committee, and (2) to amend.

You use the refer to a committee motion whenever you feel that the chapter should study the proposition more carefully before voting on it. You rise and say, "**Mr. or Miss President.**"

When recognized, you then say: "**I move that this question be referred to a committee.**"

This motion must be seconded. It can be amended. It can be debated. It cannot be reconsidered once the committee has begun its study. It requires a majority vote.

The motion to amend seeks to modify or change the motion under consideration. When you wish to make it, you must rise and say, "**Mr. or Ms. President.**"

When you have been recognized by the President, you might say, "**I move to amend the motion by striking out the word 'annual.'**"

When you make this motion, you must be sure to state definitely the way in which you want the amendment made.

Motions that arise out of debate are called incidental motions. They are concerned with small matters that can readily be settled. For example, a member desires to know some matter of information (point of information) or a member desires to question a vote (divide the assembly), or a member desires to know if the proper procedure is being followed (point of order).

A main motion brings a new proposal before the chapter. It is only in order when no other main motion is being debated.

A main motion is subject to six conditions:

1. It must be seconded.
2. It can be amended.
3. It can be debated.
4. It can be reconsidered — that is, brought up a second time.
5. It can have additional motions that change it.
6. It requires a majority vote.

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STUDENT HANDOUT NO. 8

DUTIES FOR IN-CLASS USE OF COMMUNITY RESOURCES

The activity will help students learn how to invite and properly use a guest speaker in the Industrial Arts class. The particular content of the course or lesson will determine the type of resource person who should be contacted. The student learns to call, talk with, write letter, and introduce a speaker as part of classroom instruction.

Officer and Committee Duties

Community Resources Committee	This committee of the class meets often during the semester to find ways for industry and community resources to be used for the Industrial Arts class or laboratory. Types of resources include speakers, field trips and laboratory materials which help class with chosen activity. Teacher may suggest possible speakers related to technical or career aspects of the course.
President	Opens meeting to hear report of Community Resources Committee and involve class in deciding resources for class to use. Relatives, friends, industrial workers or business leaders may be suggested by class members. Class votes to use a resource in cooperation with teacher and school office.
Vice president	May prepare sample questions for class members to ask speaker.
Secretary	Records suggested names of community resources and records any decisions made by class.
Treasurer	Most speakers will not require any financial assistance; however, if near lunch period the class may ask person to stay for lunch at school.
Parliamentarian	Helps class use proper procedures for inviting, talking to and thanking a resource speaker.
Reporter	Assures speaker will be met by committee or officer. Obtains information about speaker to announce to other teachers if appropriate.
Sgt. at Arms	Assures speaker is not interrupted while talking with class.
Historian	Records or videotapes speaker so speech can be saved for use with other classes.

TYPICAL SCHEDULE FOR USING A SPEAKER

class Meeting 1	Teacher explains that there are various resource persons in the community who could speak to the class and help them learn additional information.
2&3	Students survey community for resources related to the topics of the course.
4	Industrial/Community Resource Committee reports to class on those resource person they have considered good for the course content. Class officers conduct meeting of class to vote on one person to invite to speak.
5	Committee writes letter to invite resource person giving dates suggested by teacher and with approval of principal's office.
6&7	Committee prepares questions and gathers information related to speaker or the industry.
8	Teacher follows up letter by calling the speaker to discuss dates, times, topic and school policies related to outside speakers.
Day of Speaker –	Committee meets speaker at arrival time and introduces speaker to principal, teacher and class. (Other teachers or classes may also attend.) Class members ask questions at appropriate time. Other committees or groups may seek advice on their activities or projects using the resource person as a consultant.
After speech	Reporter writes news story about speaker and talk. Thank you letter is written to speaker. Recordings of speech are shared with other classes or information is filed so that speaker can be invited again.

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STUDENT HANDOUT NO. 9

DUTIES FOR IN-CLASS SERVICE PROJECTS

The activity will use the procedures of the "Group Project" method which begins on Page 40 of the Exploring Technology Guide. The method uses "student involvement, interaction and skills to produce one or more tangible products ..." Leadership and followership are developed as students work together in the laboratory as one industry to produce a product.

Officer and Committee Duties

Service Committee:	Meets to screen or encourage and select a service project for the class to build.
President:	Opens meeting to hear report of Service Committee and involve class in decision. Class votes on service to be provided to another group.
Vice president:	Reproduces organizational chart for group project system and asks class to determine who will take each position.
Secretary:	Keeps minutes of class meeting and records names of students who are members of group project.
Treasurer:	Advises class on financial details related to service project.
Parliamentarian:	Advises class on proper procedures for obtaining permission.
Sgt. at Arms:	May suggest services or improvements needed within laboratory such as tool holders or safety devices.
Reporter:	Writes story about plans of class to build a service project to help others. Takes photos of work and delivery for story.
Historian:	May share information on previous projects related to this one. Keeps records for other classes to use for reference.

TYPICAL SERVICE PROJECT SCHEDULE

Class Meeting 1:	Teacher explains group project method to class and students discuss possible service projects for Service Committee to consider.
2:	Service Committee reports to class a recommended service project and class selects project to build.
3:	Class Vice-President distributes organizational chart for Group Project and may have students apply for positions.
4:	Students report during seminar on role or duties they hold in Group Service Project. Research and Design Directors work to determine specifications and prepare drawings.
5:	Students apply for jobs in the organization.
6, 7 & 8:	Teacher may demonstrate technical areas related to project selected as needed in construction.
9:	Students use laboratory to build sub-parts of project.
10:	Reporting seminar permits students to present work completed or problems solved.
11:	Students use laboratory to assemble or complete project.
12:	Reporter and Historian write stories for public information.
13:	Teacher evaluates each student's participation as to technical knowledge gained and interest in helping others.

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STUDENT HANDOUT NO. 10

DUTIES FOR IN-CLASS ENTERPRISING PRODUCTS

This activity will use the procedures of the "Line Production" method which begins on page 49 of the **Exploring Technology Guide**. The method is used "to acquaint students with: the ways in which contemporary industry organizes people, materials, and machines into a common endeavor; the study of occupations related to areas of management and labor within industry . . ." The student learns to develop a company, solve management problems and realize profits from a salable product or service.

Officer and Committee Duties

Enterprising Committee:	This committee of the class meets separately to design or select products or services to enterprise for a profit. May use criteria for product selection, sketches or mockups. Organize sales training for all class members such as: Making sales presentations, taking orders and keeping records of sales contacts made, good manners and courteous behavior.
President:	Opens meeting to hear report of Enterprising Committee and involve class as Board of Directors in deciding what product to make and how profit will be used after product is sold.
Vice-President:	Reproduces an organizational chart of a company and sample personnel roles for distribution to students.
Secretary:	Records information decided by Board of Directors and result of voting for General Manager in the company.
Treasurer:	Helps determine financial needs of class and determine capital needed to begin production. Suggests recordkeeping system for enterprise.
Parliamentarian:	Prepares mock incorporation papers for the company and obtains approval from school officials with teacher.
Sgt. at Arms:	Assigns cleanup duties appropriate to production activity of class.
Historian:	Files records and samples of every phase of activity for other classes to use.
Reporter:	Selects or makes promotion materials to advertise product or service to school.

TYPICAL ENTERPRISING PRODUCT SCHEDULE

Class Meeting 1. Teacher explains line production method that class will use to raise funds for activity they select.

2. Enterprising Committee reports to class showing sketches or mockup models of products which could be produced and sold. Class votes on product and activity as the Board of Directors.
3. Vice-President distributes organizational chart for company. Class votes for person to lead as General Manager.
4. General Manager selects second line management and the Personnel Director to hire all other employees.
5. Design Engineer presents drawings to class and will prepare a very accurate prototype with the help of the production and industrial engineering departments.
6. Assess school for product sales appeal.
7. Each person will report on completed duties accomplished in the role held.
8. Personnel Manager will assign students to make necessary jigs and fixtures.
9. Assign students to work stations and try out a test run.
10. Production of products on assembly line.
11. Advertising personnel will design and produce posters and order forms for product sales.
12. Prepare a marketing management system to control products. Record who is contacted and sales information.
13. Deliver product to customer.
14. Account for all purchases, sales and losses.

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STUDENT HANDOUT NO. 11

DUTIES FOR IN CLASS CONTESTS OR RECOGNITION

This activity will involve students in contests which are provided at local, regional, state and national conferences. Thus, students may practice and compete in tool identification, prepare an exhibit or give a speech as part of the way they are learning Industrial Arts. The teacher should suggest those contests to the Recognition Committee that relate to the course the students are taking.

Officer and Committee Duties

Recognition Committee:	This committee of the class meets to determine what contests relate to class and study rules for possible contests to be held in class or laboratory.
President:	Opens class meeting to hear report of Recognition Committee and involve students in selecting contest for class to use.
Vice President:	Assists with organizational chart to show how students will compete.
Secretary:	Writes letters to persons who will be asked to serve as judges.
Treasurer:	Assists in determining and purchasing awards to be given to winners.
Parliamentarian:	May help select judges for contests and review rules for participation.
Sgt. at Arms:	May assist judges in keeping order or use of rules.
Reporter:	Writes up news stories about contests, exhibit or demonstration and announces winners. May invite community or other students to see contests.
Historian:	Keeps records of each activity and files records or photos for future reference.

DUTIES FOR IN CLASS OPEN HOUSE EXHIBITS

This activity will involve students in gaining recognition for their achievements in the industrial arts course. The officers of the class will assist with the activity and every student will not only help but will also contribute projects to be exhibited.

OFFICER AND COMMITTEE Duties

Recognition Committee:	This committee of the class meets to determine what type of Open House will be appropriate to the course and works with teacher to arrive at the best date.
President:	Opens class meeting to hear report of the Recognition Committee and involve class members in the decisions related to the Open House.
Vice President:	Assists with the organizational procedures and work assignments of committee members and officers.
Secretary:	Writes letters or helps with invitations send to school personnel and others class wants to invite.
Treasurer:	Records expenses incurred during the Open House activity and seeks funds to meet these costs.
Parliamentarian:	Makes sure that proper procedures are followed as visitors are invited or other arrangements are made within the class or school.
Sgt. at Arms:	May assist committee in setting up exhibit tables and arranging for or cleaning up after open house.
Reporter:	Helps to publicize the Open House around the school. Takes photos and writes story before and after the event for the newspaper.
Historian:	Files and keeps information or photos of the event for use by future students.

SCHEDULES FOR RECOGNITION EVENTS

USING A CONTEST IN CLASS

1. Teacher presents idea and purpose of contest during class time.
2. Recognition Committee suggests possible contests for class to use.
3. Officers lead class meeting to decide of contest to be used.
4. Committee reviews or plans rules and organizes time schedule for individuals to compete.
5. Students practice during class or as homework.
6. Students or other judges select up to six finalists.
7. Finalists compete before judges and awards are presented to each.
8. Reporter and other officers carry out their duties.

ENTERING A CONTEST

1. Obtain and study contest guidelines or rule books.
2. Complete forms to pre-register in contest.
3. Mail forms to Spring Festival Contest Chairperson.
4. Prepare and practice for event in class, school and as homework.
5. Demonstrate to class and other school groups for judging or criticism.
6. Dress and conduct oneself appropriately for judging.
7. Appear at scheduled time for contest and awards program.

HOLDING AN OPEN HOUSE

1. Class decides if open house will be by class alone or request school AIASA to cooperate.
2. Obtain permission from school office date and place of open house.
3. Organize class members to help with various set-up details.
4. Announce to students how to enter projects for open house exhibit.
5. Send invitations to school personnel, parents and community resources.
6. Provide recognition for those who participate.

GIVING A TECHNICAL DEMONSTRATION

1. Select a technical topic which would interest or help other people.
2. Prepare research report or speech on the topic of demonstration.
3. Make models or assemble tools for demonstration.
4. Practice giving demonstration in class, school or as homework.
5. Arrange time and place to give demonstration such as State Fair, shopping mall or open house.
6. Dress and conduct oneself in professional way prior to and during demonstration.
7. Provide demonstration and answer questions of those who watched.

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STUDENT HANDOUT NO. 12

REGIONAL, STATE, AND NATIONAL RECOGNITION EVENTS FOR INDUSTRIAL ARTS STUDENTS

TECHNICAL PERFORMANCE CONTESTS
- Architectural Drawing
- Engineering Drawing
- Electricity/Electronics
- Graphic Arts
- L.S.R.A.V. (model race cars)
- Leathercraft
- Photography
- Metal Machining
- Small Engine Trouble Shooting
- Tool and Machine Identification
- Woodturning - between centers
- Woodturning - face plate
- Screen Process Printing (hand cut film)
- Metric 500 Race

GENERAL CONTESTS
- General Knowledge Test
- Public Speaking Contests (prepared and extemporaneous)
- Chapter Team Contest
- Research Paper Entry Contest
- Safety Poster Entry Contest
- Technical Writing Contest

- Booth or Display Contests
- Co-Curricular Activity Exhibit
- Community Service Project Exhibit
- Scrapbook or Record Book Exhibit
- Fund Raising Project Exhibit
- Booth Exhibit

PROJECT EXHIBIT CONTESTS (enter by course title and course code)
- Exploring Technology
- Modern Industry
- Construction
- Manufacturing
- Communications Technology
- Materials and Processes Technology
- Power and Transportation Technology
- Architectural Drawing
- Basic Technical Drawing
- Electricity and Electronics
- Energy and Power
- Engineering Drawing
- Graphic Communications
- Metals Technology
- Woods Technology
- General Industrial Arts
- Industrial Crafts
- (for other titles see Spring Festival Permanent Rules)

CHECKLIST FOR CONTEST PARTICIPANTS

Directions: Performance and leadership contests are judged on the following aspects. To assist students to improve themselves for the contest these statements can be checked off by another person.

Technical Understanding

_____1. Accurate information used from books and research.
_____2. Impact or value of technology understood.
_____3. Safety procedures are used or described.
_____4. Information reviewed or approved by teacher.

Leadership

_____1. Leadership ability is exhibited.
_____2. Experienced as officer or participant in A.I.A.S.A.
_____3. Voice and mannerisms are appropriate.
_____4. Assists with projects of class.
_____5. Helped arrange materials and forms for entry into contest.
_____6. Sent registration materials to contest chairperson.

Career Information

_____1. Knows at least 5 careers related to contest.
_____2. Understands requisites for career entry.
_____3. Lists programs for occupational preparation.

Performance

_____1. Shows interest and enthusiasm.
_____2. Dressed appropriate to contest.
_____3. Presents or demonstrates information in orderly manner.
_____4. Develops eye contact.
_____5. Voice and manner professional.
_____6. Paper organized well and holds interest.
_____7. Writing is accurate and to the point.

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Calendar of Activities

August	September	October
November	**December**	**January**
February	**March**	**April**
May	**June**	**July**

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FMC

FMC Corporation An equal opportunity employer

Application for employment/Hourly Personnel

It is the policy of FMC Corporation to provide equal opportunity for all qualified persons and not to discriminate against any employee or applicant for employment because of age, race, creed, color, sex, national origin, or handicap.

Date

Return completed application to:

PERSONNEL DEPARTMENT
FMC CORPORATION
FLUID CONTROL DIVISION
Stephenville Plant
2825 West Washington
P. O. Box 1377
Stephenville, Tx. 76401
817/968-2181

IDENTIFICATION

(Print) FIRST NAME	MIDDLE NAME	LAST NAME	SOCIAL SECURITY NUMBER
LOCAL ADDRESS — STREET AND NUMBER			TELEPHONE
PERMANENT ADDRESS — STREET AND NUMBER			TELEPHONE
ARE YOU A U.S. CITIZEN? IF NO, WHAT TYPE VISA DO YOU HOLD? ☐ YES ☐ NO			
NAME OF PERSON TO BE NOTIFIED IN CASE OF EMERGENCY	CITY	STATE ZIP	TELEPHONE

PREVIOUS EMPLOYMENT

FROM	TO	NAME OF COMPANY	ADDRESS	POSITION	REASON LEFT	WAGE	May We Contact
			STREET _____ CITY _____ STATE _____				
			STREET _____ CITY _____ STATE _____				
			STREET _____ CITY _____ STATE _____				

PREVIOUS EXPERIENCE

CHECK MACHINES YOU HAVE OPERATED

___ Single Spindle Drill Press	___ Engine Lathe	___ Universal Grinder	___ Heat Treat Equipment
___ Multiple Spindle Drill Press	___ Bullard Boring Mill	___ Internal Grinder	___ Lift Truck
___ Radial Drill	___ Automatic Chucker	___ External Grinder	___ Overhead Crane
___ Automatic Screw Machine	___ Milling Machine	___ Cold Heading Machine	___ Electric Welder
___ Hopper or Gear Cutter	___ Horizontal Boring Mill	___ Punch Press	___ Acetylene Welder
___ Turret Lathe	___ Borematic	___ Swag Grinder	___ Auto. Weld Machine
___ Bending	___ Iron Pounding	___ Core Making	___ Foundry Laborer

OTHER MACHINES OPERATED _____

DO YOU SET UP _____ LAYOUT _____ READ BLUE PRINTS _____ MACHINE DRAWINGS _____ HAVE BASIC TOOLS _____

POSITION DESIRED _____ EARNINGS EXPECTED _____

SHIFT YOU CAN WORK: 1 2 3

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Additional Experience

State what you did in any periods not already covered, including part-time or self employment. Additional sheets may be used.

Dates	

EDUCATION

	NAME OF SCHOOL	LOCATION	Dates Attended From	Dates Attended To	Years Credit	Year Grad.	Degree	Course or Major Subject
High School								
Business or Trade School								
College or University								
Other								

U.S. MILITARY SERVICE

Branch of U.S. Service	Date Entered Month	Date Entered Year	Date Discharged Month	Date Discharged Year	Rank at Discharge	Type of Discharge

Nature of duties and any special training and honors received

Have you ever received a military disability pension? If so, give nature of disability

Present draft, reserve or military status

REFERENCES

NAME (not a relative or employer)	COMPLETE MAILING ADDRESS	OCCUPATION

REMARKS

Have you ever been convicted of, or entered a plea of guilty to a felony?

☐ Yes ☐ No If yes, explain fully

List serious operations, accidents, illnesses, disabilities, and limitations (if none, so state)

Have you ever received Workman's Compensation for an industrial illness, injury? ☐ Yes ☐ No If yes, explain.

SIGNATURE

It is understood and agreed that any willful misstatement made by me in this application will be sufficient cause for discharge from the Company's service if I have been employed. It is also understood that this employment is subject to satisfactory completion of a physical examination by a company designated physician at the time of employment and at such time as may be required by the company.

Date

Signature of applicant

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Work experience

Present or last employment

Previous employment

Additional experience

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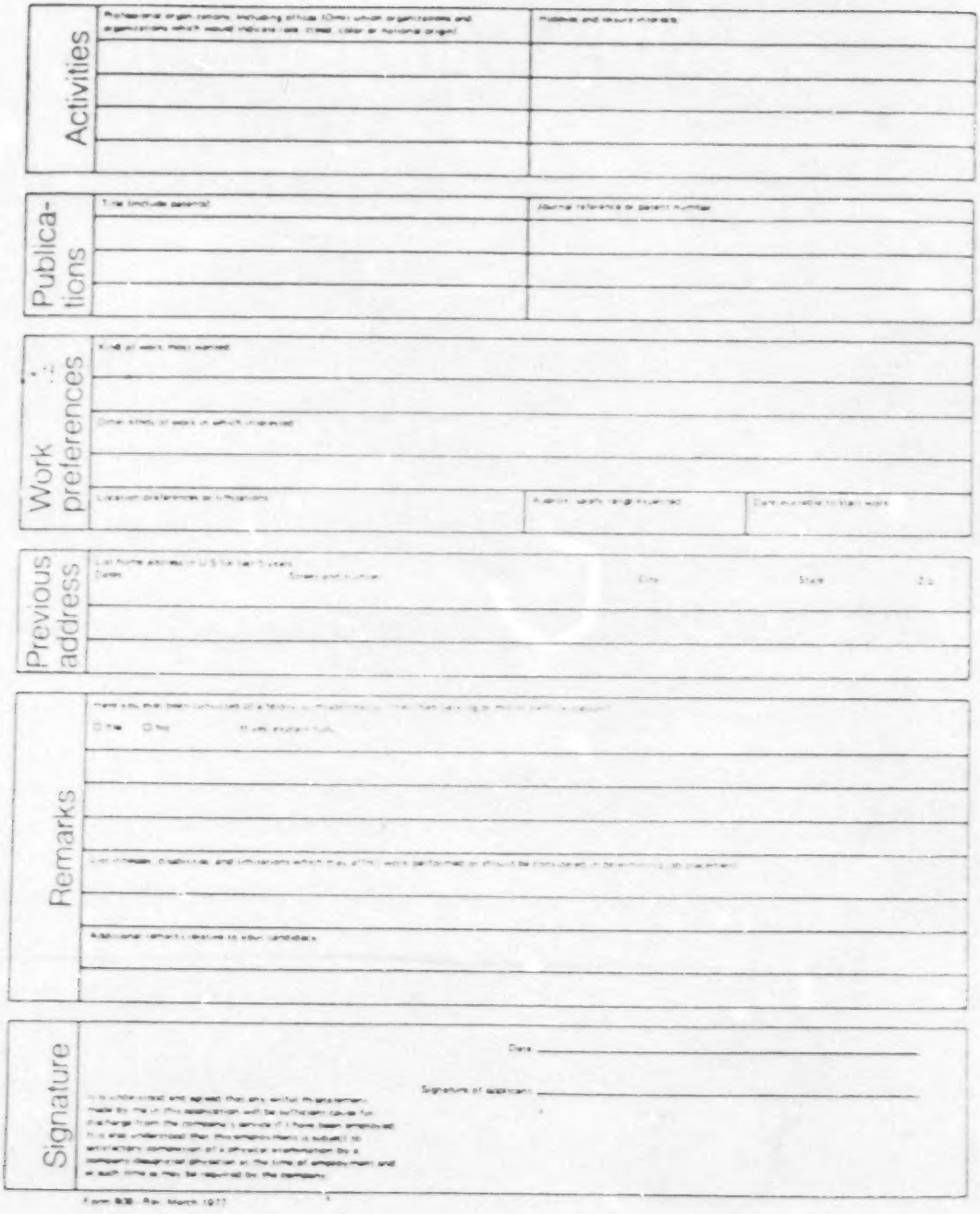

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FMC

FMC Corporation An equal opportunity employer

Application for employment | salaried personnel

It is the policy of FMC Corporation to provide equal opportunity for all qualified persons and not to discriminate against any employee or applicant for employment because of race, color, religion, sex, national origin, age or handicap.

Date

Return completed application to

FMC Corporation
Fluid Control Division
2925 West Washington, P. O. Box 1377
Stephenville, Texas 76401, (817)968-2181

Identification

(print) First name — Middle name — Last name — Social security number

Legal address Street and number — City — State — Zip — Telephone

Permanent address Street and number — City — State — Zip — Telephone

Name of person to be notified in case of emergency — Telephone

Address Street and number — City — State — Zip

Are you a U.S. citizen? If no, do you have a visa right to remain in the U.S.?
☐ Yes ☐ No ☐ Yes ☐ No If yes, how long?

U S military service

Branch of U.S. service — Date entered: Month, Year — Date discharged: Month, Year — Rank at discharge — Type of discharge

Nature of duties and any special training and honors received

Present draft classification or military status

References

If applying for professional or technical position, include at least one professional reference familiar with your work performance

Name (not a relative or employer)	Complete mailing address	Occupation

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Education and training

Education

Name of school	Location	Dates attended From	Dates attended To	Years credit	Year grad	Degree	Course or major subject
High school							
Business or trade school							
College or university							
Graduate study							
Other							

Note: A copy of your college transcript should accompany this application if you graduated from college within last 5 years.

High school and undergraduate record

	High school	College (undergraduate)
Scholastic standing (rank/rank if not known)	Average grade, standing in class, etc.	Average grade, gradepoint, standing, etc.
Scholastic honors		Significant courses in major subject attended within last 5 years
Significant extracurricular activities attended within last 5 years		Examinations passed (name and how marked)

Graduate study

Field of graduate study	Scholarship, fellowships, assistantships, etc.	Name of major professor
Courses in subsidiary fields		Research problems

Special training or qualifications

Languages spoken fluently	Languages read fluently	Typing (if you have typed)
Office machines operated		
Typing speed ____ wpm	Shorthand speed ____ wpm	

Describe any other skills, training or skills which are in any way related to the kind of work you want to do.

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GENERAL DYNAMICS
Fort Worth Division
P. O. Box 748 Fort Worth, Texas 76101 (Mail Zone 1862)

APPLICATION FOR EMPLOYMENT

GENERAL DYNAMICS IS AN EQUAL OPPORTUNITY EMPLOYER AND COMPLIES WITH ALL LAWS PROHIBITING DISCRIMINATION

DATE OF APPLICATION

GENERAL INSTRUCTIONS: It is important that you fill out this application blank thoroughly and completely. Please attach a supplementary sheet to this application with additional information if there is insufficient space provided under any of the entries below. A careful preplacement physical examination is required for all new employees at which time consideration will be given to any physical condition which may have a bearing on placing you safely and suitably. This application must be filled out by you personally. Military discharge papers, birth certificate, and social security card are required at time of interview.

Name | ☐ Male ☐ Female | Date of Birth | Height | Weight | Social Security No.

(Last) (First) (Middle - No Initial)

Present Address

Number Street City (State) Zip Code Phone

Permanent Address

Number Street City State Zip Code Phone

U.S. Citizen ☐ YES ☐ NO | If not a citizen, enter Alien Card No.

Do you have any relatives working at General Dynamics? ☐ YES ☐ NO If "Yes" indicate name, relationship, division where employed

Have you ever worked for General Dynamics? ☐ YES ☐ NO If "Yes" indicate where, when, which division

List ailments, physical defects, previous injuries (if none, write "NONE").

Have you ever been convicted for any violation of any federal, state, county, or municipal law? Include all court-martial while in military service. Do not include traffic violations in which the only penalty was a fine of $25 or less. Write in YES or NO. _____ If "YES", give date, place, charge, and disposition in the following space. Attach sheet if necessary.

EDUCATION - Overflow information may be put on another sheet and attached. If college graduate, copy of college transcript or course outline would be helpful.

TYPE	NAME	LOCATION	MONTH & YEAR ATTENDED FROM	TO	MAJOR AND MINOR COURSES	DEGREES CONFERRED AND DATE
HIGH SCHOOL						
COLLEGE OR UNIVERSITY						
TRADE SCHOOL OR OTHER SPECIAL TRAINING						

GRADE POINT AVERAGE: Undergraduate ____ Out of Possible ____ | Graduate ____ Out of Possible ____ | Approximate Rank in Class ____ of ____ | Percent of College Expenses Earned | Graduate Thesis Subject

Extra Curricular Activities

Future Educational Plans

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EMPLOYMENT RECORD - List employers in the order in which you worked for them, showing most recent employer first. Include military service, periods of unemployment and self employment, such as farming, etc.

FIRM NAME AND ADDRESS (GIVE COMPLETE ADDRESS)	MONTH AND YEAR EMPLOYED	POSITION AND DUTIES (More Complete Details May Be Furnished by Attaching Resume or by Utilizing Space in Remarks)	BASE RATE OF PAY	REASON FOR LEAVING
Employer Street Address City State Zip Code	Started Terminated	Supervisor	Starting Ending	
Employer Street Address City State Zip Code	Started Terminated	Supervisor	Starting Ending	
Employer Street Address City State Zip Code	Started Terminated	Supervisor	Starting Ending	
Employer Street Address City State Zip Code	Started Terminated	Supervisor	Starting Ending	
Employer Street Address City State Zip Code	Started Terminated	Supervisor	Starting Ending	
Employer Street Address City State Zip Code	Started Terminated	Supervisor	Starting Ending	
Employer Street Address City State Zip Code	Started Terminated	Supervisor	Starting Ending	

May we contact your present employer? ☐ YES ☐ NO

Will you work any shift? ☐ YES ☐ NO

Will you work overtime? ☐ YES ☐ NO

Will you work Saturday? ☐ YES ☐ NO

Will you work Sunday? ☐ YES ☐ NO

List type of work preferred

What is your minimum salary requirement?

Date available for employment

Have you ever been granted a security clearance? Answer Yes or No. _____ If answer is "Yes" indicate level of clearance and where employed when cleared.

Have you ever had a security clearance suspended, denied, or revoked? Answer Yes or No. _____ If answer is "Yes" where were you employed at that time?

Except for reasons of a reduction in force, have you ever terminated employment while a request or application for a security clearance was pending? Answer Yes or No. If answer is "Yes" where were you employed at that time?

REFERENCES - Six required - use full names.
PROFESSIONAL - Previous supervisors preferred. If so, please indicate.

All References Must Have Complete HOME Address NOT PROFESSIONAL Address

COMPLETE NAME	BUSINESS	COMPLETE ADDRESS

CHARACTER - Do not list relatives or former employers.

All References Must Have Complete HOME Address NOT PROFESSIONAL Address

COMPLETE NAME	BUSINESS	COMPLETE ADDRESS

MISCELLANEOUS - Overflow information may be put on another sheet and attached.

Technical Interest

Publications

Are you now, or have you ever been a member of, or affiliated or associated with any organization, association, movement, group or combination of persons (1) which advocates or advocated the overthrow of our Constitutional Form of Government, (2) which has or had adopted a policy of advocating or approving the commission of acts of force or violence to deny other persons their rights under the Constitution of the United States, or (3) which seeks or sought to alter the form of Government of the United States by unconstitutional means? ☐ YES ☐ NO (If "Yes," list name(s) of such organization(s), association(s), movement(s), group(s) or combination of persons.)

SOCIETIES AND ORGANIZATIONS - List all societies or organizations to which you have belonged in the last 10 years (if none, write "NONE"). Omit labor organizations or organizations which might indicate race, creed, color or national origin.

ORGANIZATION NAME	CITY	STATE	YEAR FROM	YEAR TO	OFFICES HELD

ORGANIZATION NAME	CITY	STATE	YEAR FROM	YEAR TO	OFFICES HELD

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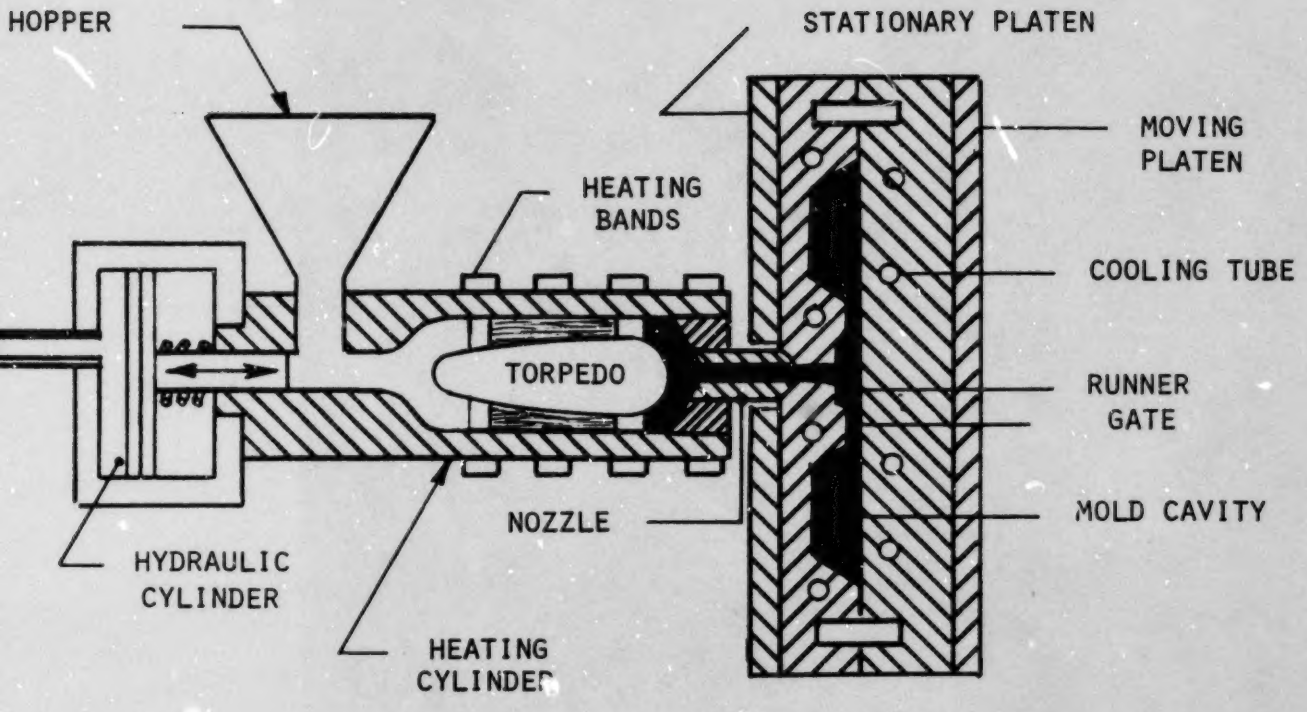
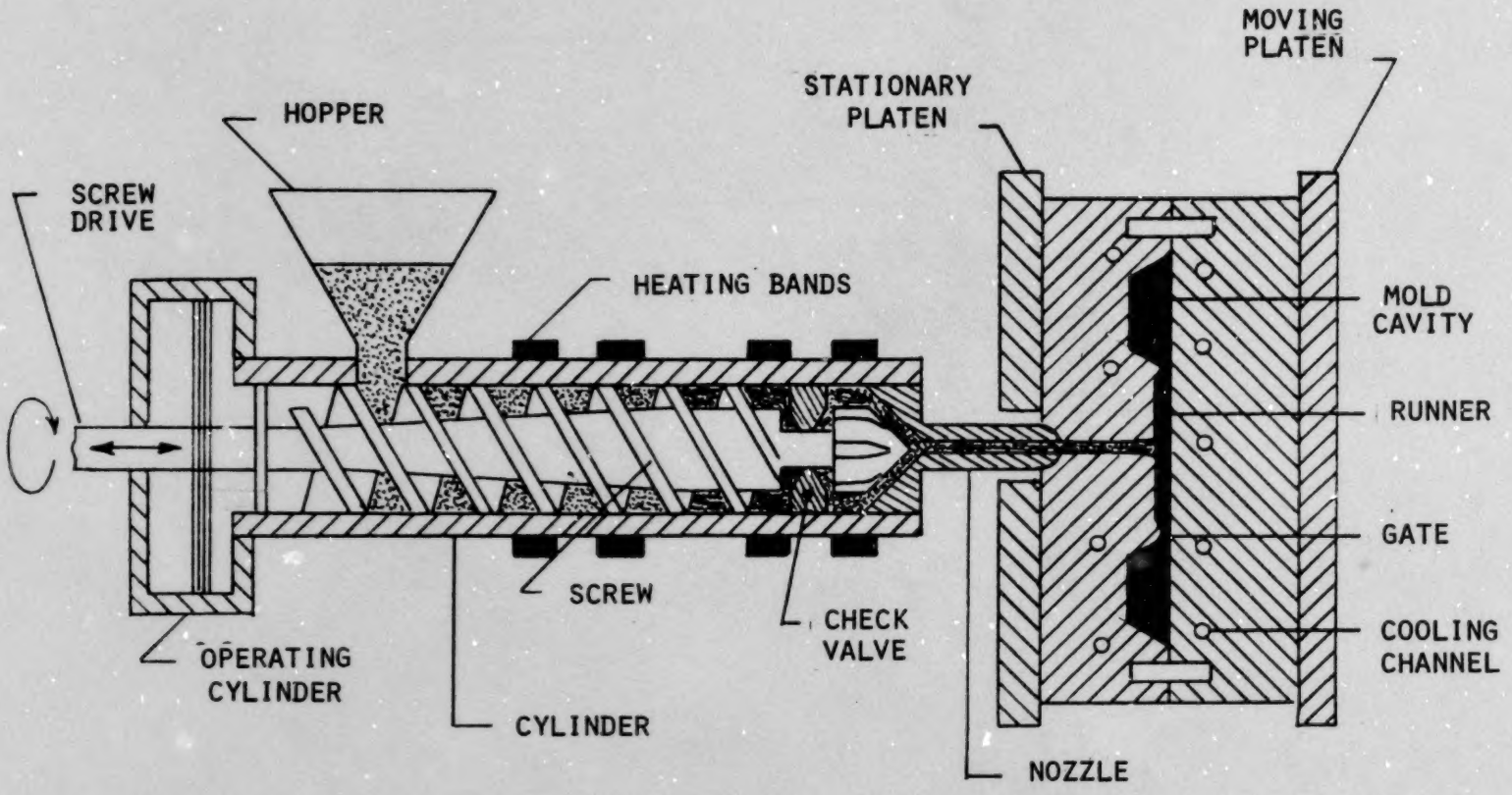


PLUNGER INJECTION MOLDER

SCREW INJECTION MOLDER



INJECTION MOLDING VARIABLES

TEMPERATURE

DEGRADATION
FLASHING
INCOMPLETE FILLING

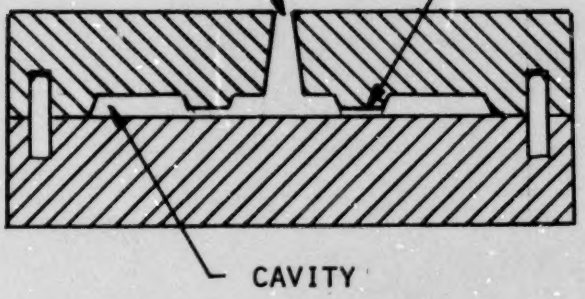
PRESSURE

FLASHING
INCOMPLETE FILLING

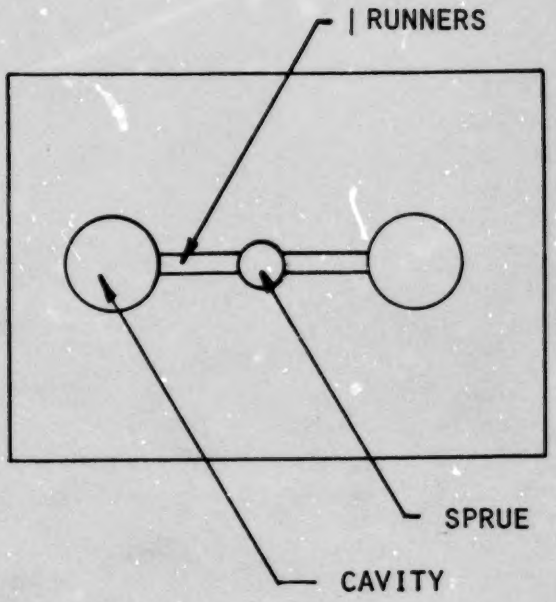
CYCLE TIME

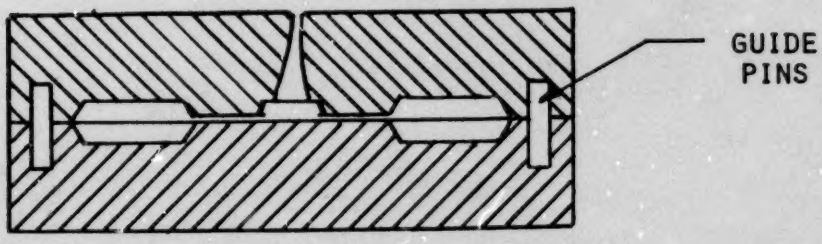
WARPAGE
FLASHING
INCOMPLETE FILLING
DEGRADATION

INJECTION MOLDS

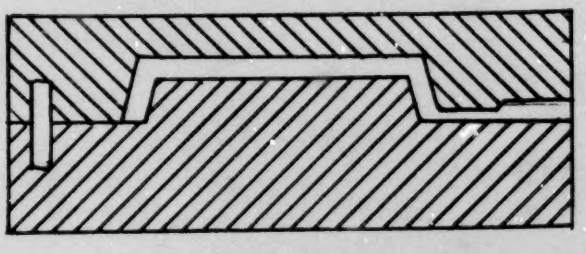


FLAT BACK





DOUBLE CAVITY

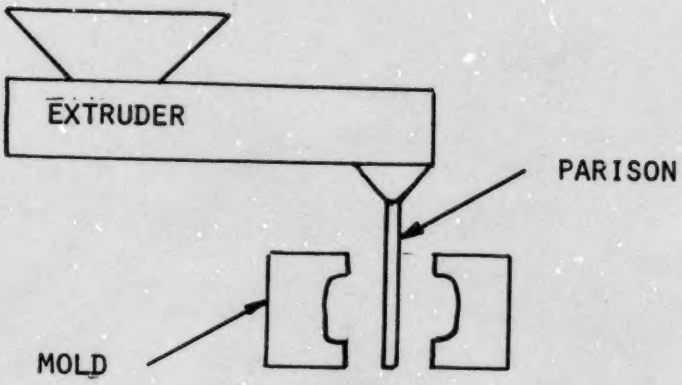


PLUG MOLD

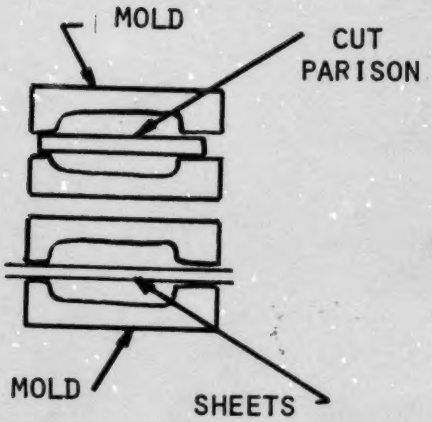
OPERATIONAL SEQUENCE
FOR
INJECTION MOLDING

1. MOUNT MOLD
2. SELECT PLASTIC
3. PLACE PLASTIC IN HOPPER
4. START MOLDER
5. COOL PART
6. OPEN MOLD AND EJECT PART
7. TRIM

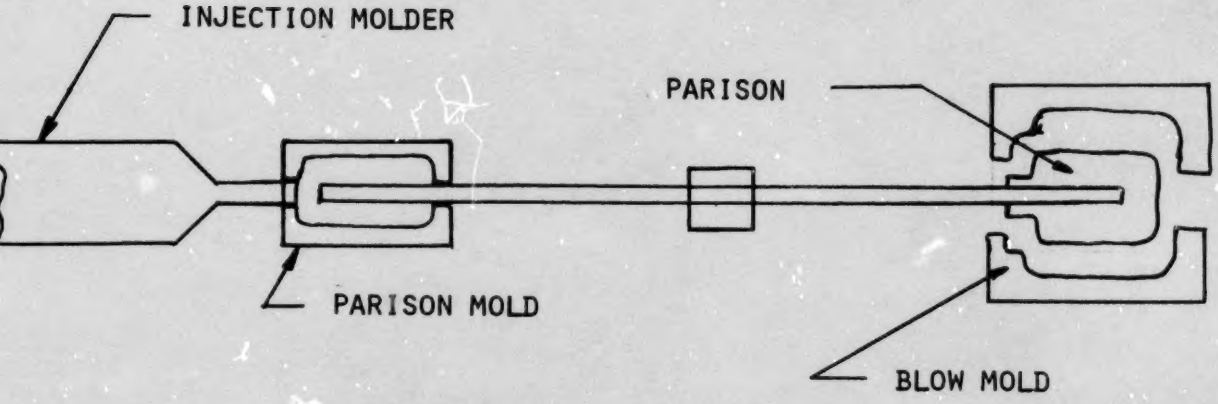
BLOW MOLDING



DIRECT PROCESS



INJECTION PROCESS

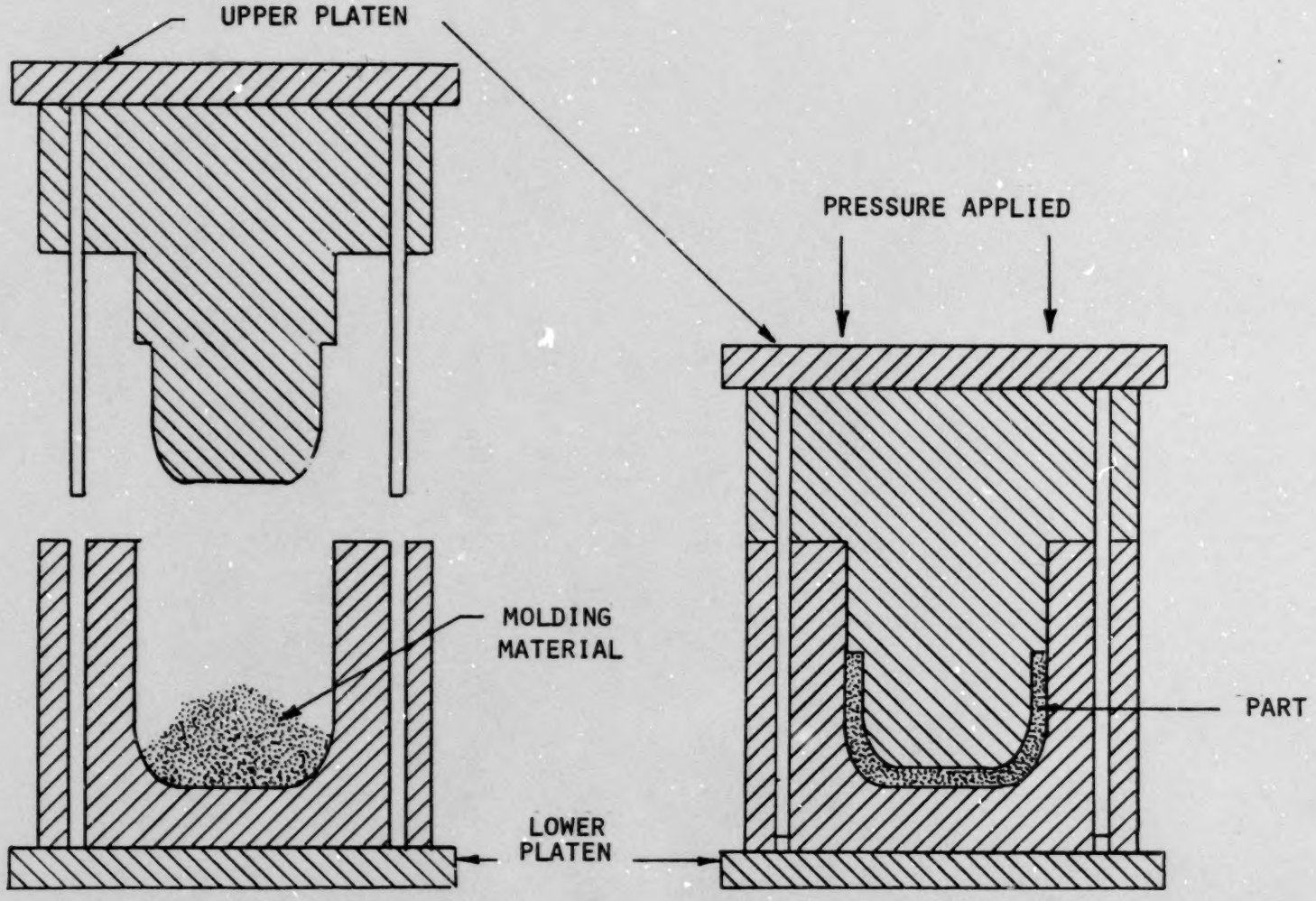


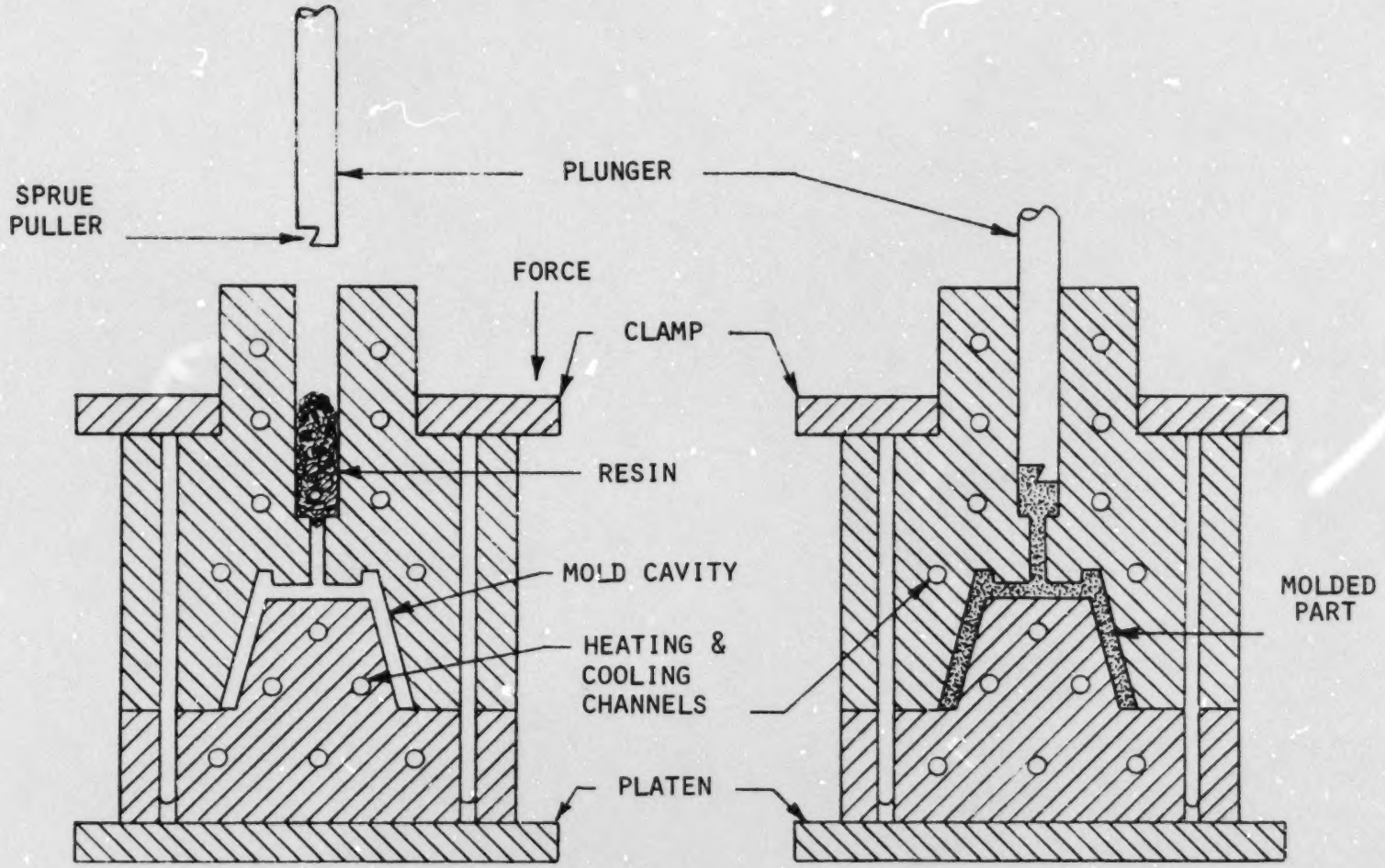
INDIRECT PROCESSES

OPERATIONAL SEQUENCE
FOR
BLOW MOLDING

1. HEAT PLASTIC
2. FORM PARISON
3. PLACE PARISON IN MOLD
4. CLOSE THE MOLD
5. INJECT AIR INTO THE PARISON
6. COOL THE PART
7. OPEN THE MOLD AND EJECT PART
8. TRIM

COMPRESSION MOLDING (FULLY POSITIVE MOLD)





TRANSFER MOLDING - SPRUE PULLER DESIGN

OPERATIONAL SEQUENCE

FOR

COMPRESSION AND TRANSFER MOLDING

1. PRE-HEAT PLASTIC AND MOLD
2. MOUNT MOLD
3. PLACE PLASTIC IN MOLD
4. MOLD
5. RELEASE PRESSURE AND ALLOW GASES TO ESCAPE
6. REAPPLY PRESSURE
7. OPEN MOLD AND EJECT PART
8. TRIM

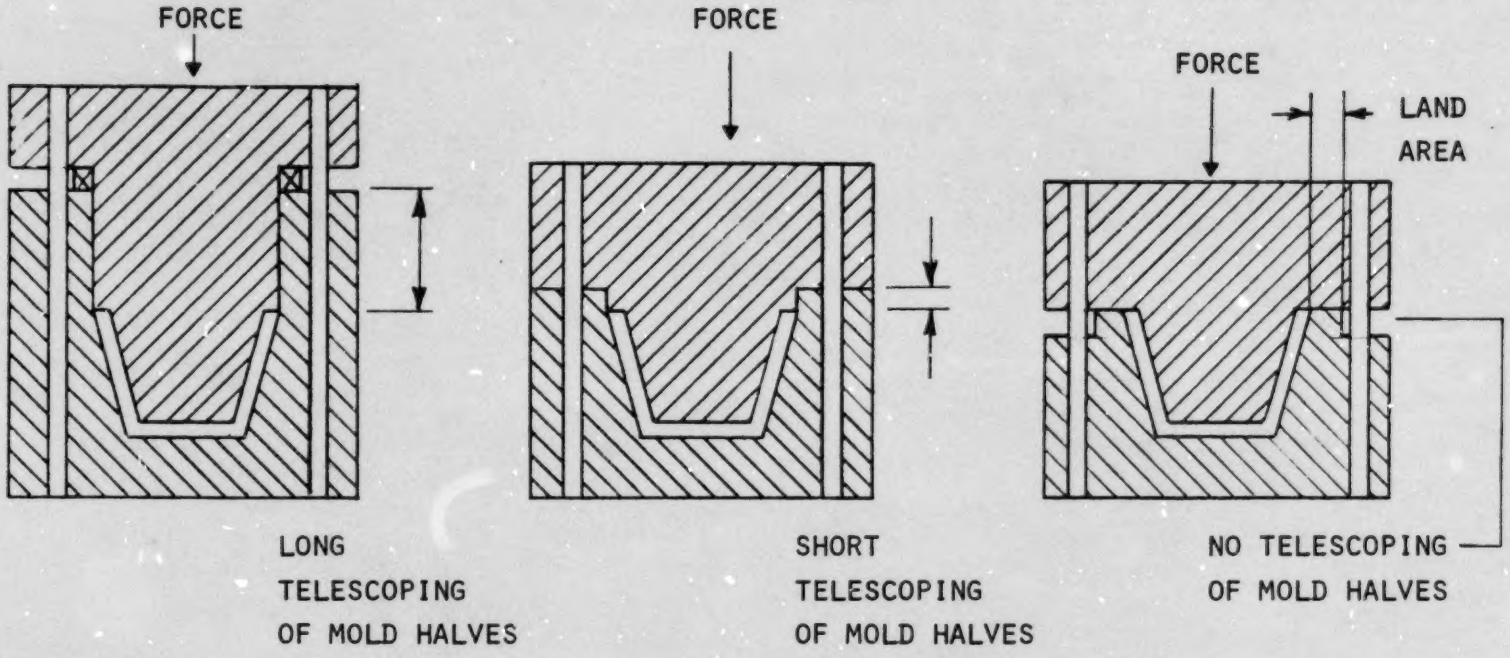
PL7-11

COMPRESSION MOLDS

LARGE STORAGE WELL
HIGH BULK FACTOR
MATERIALS CAN BE USED

SMALL STORAGE WELL
LOW TO MEDIUM BULK
FACTOR MATERIALS

NO STORAGE WELL
LOW BULK FACTOR
MATERIALS



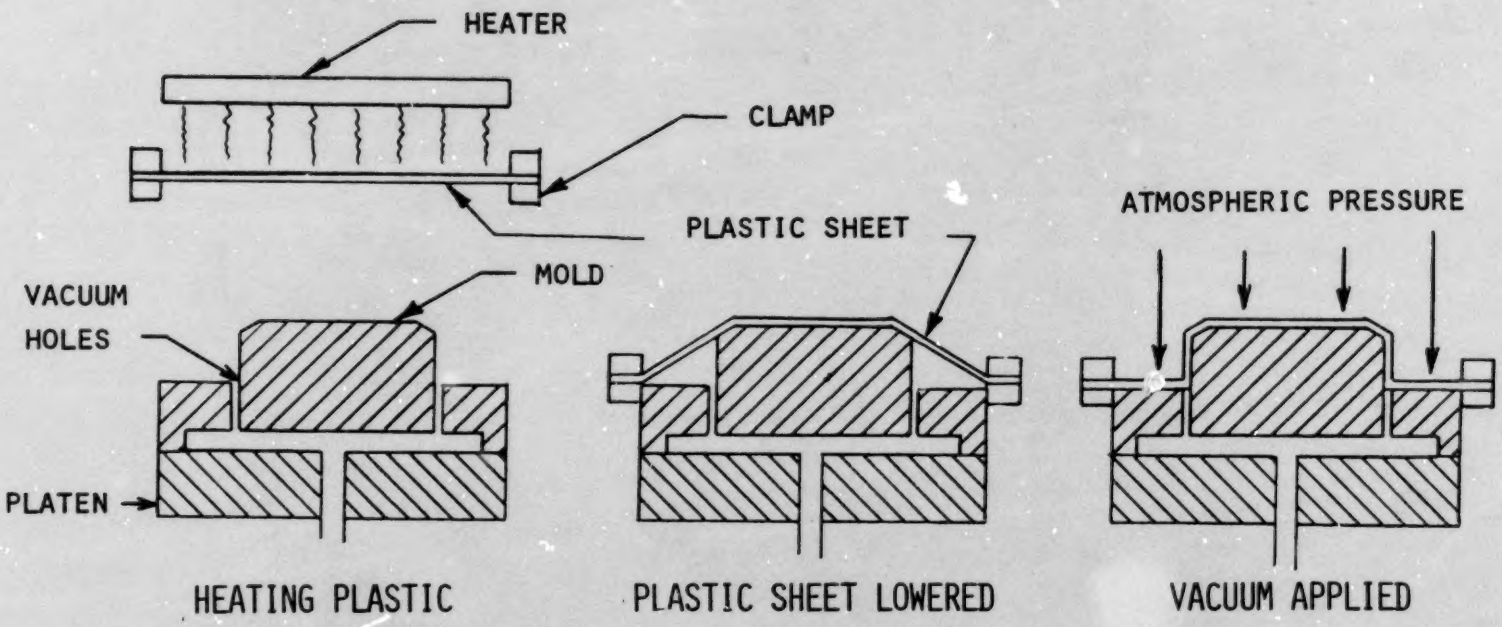
FULL POSITIVE

SEMI-POSITIVE

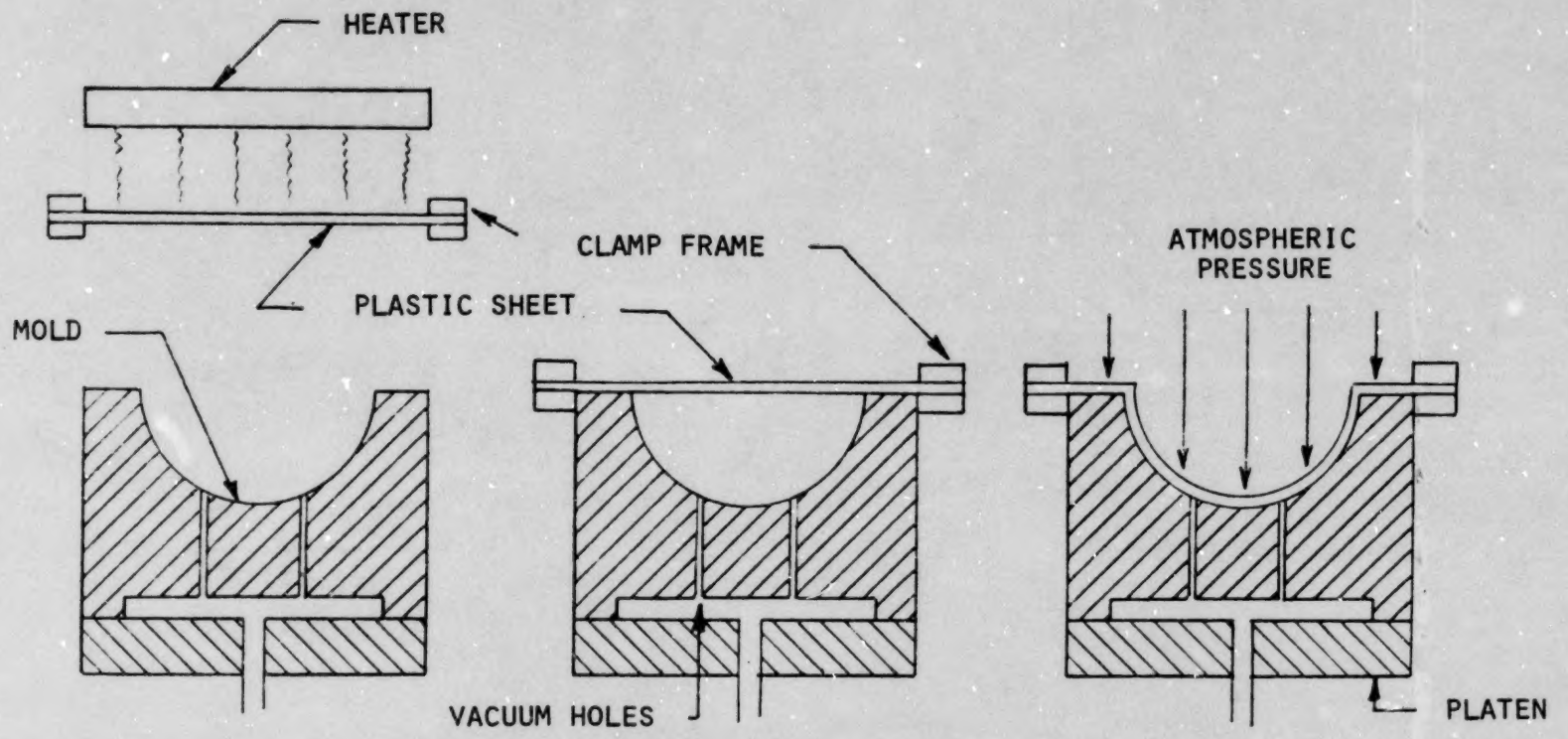
FLASH

PL7-12A

VACUUM FORMING



VACUUM FORMING



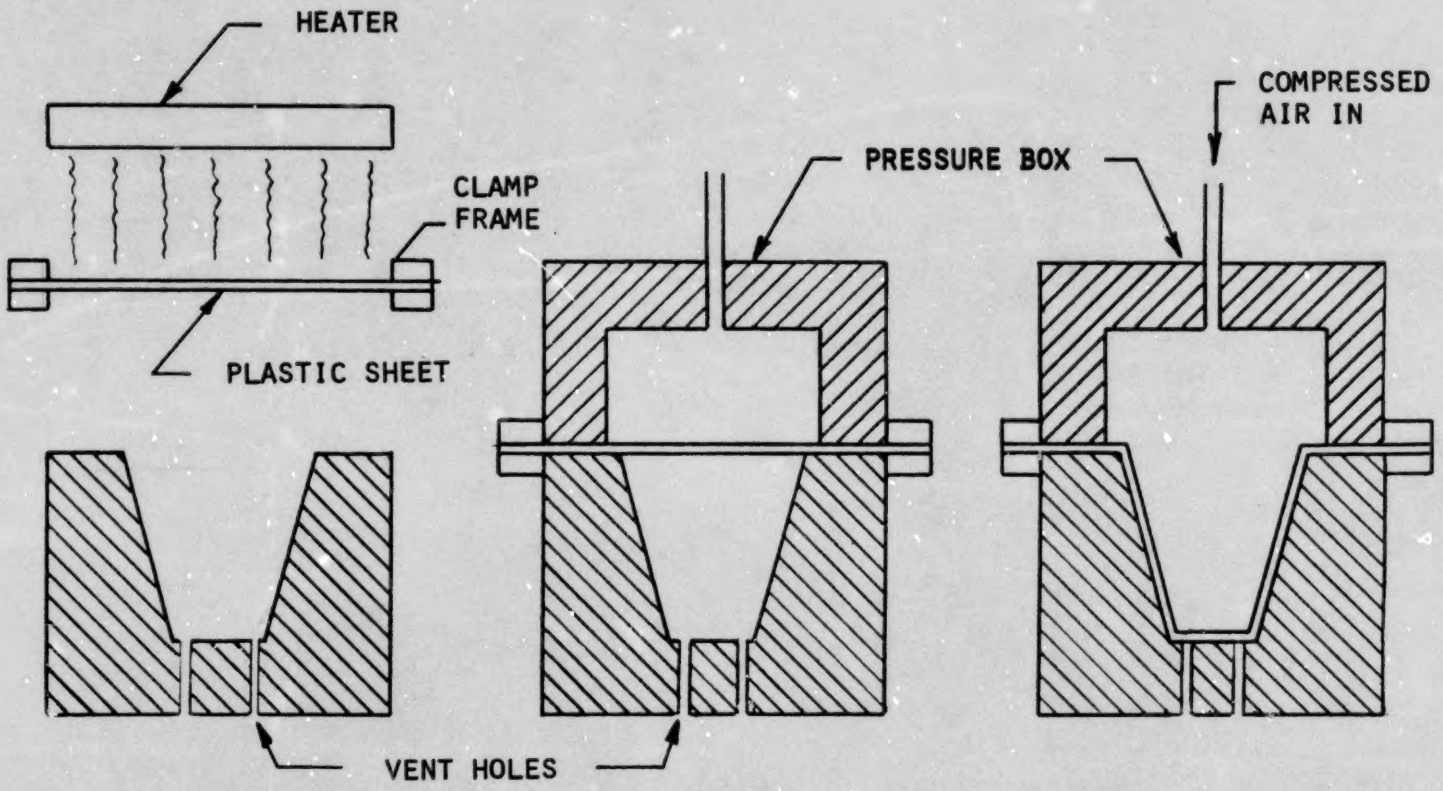
HEATING PLASTIC

PLASTIC SHEET LOWERED

VACUUM APPLIED

PL7-12B

PRESSURE FORMING



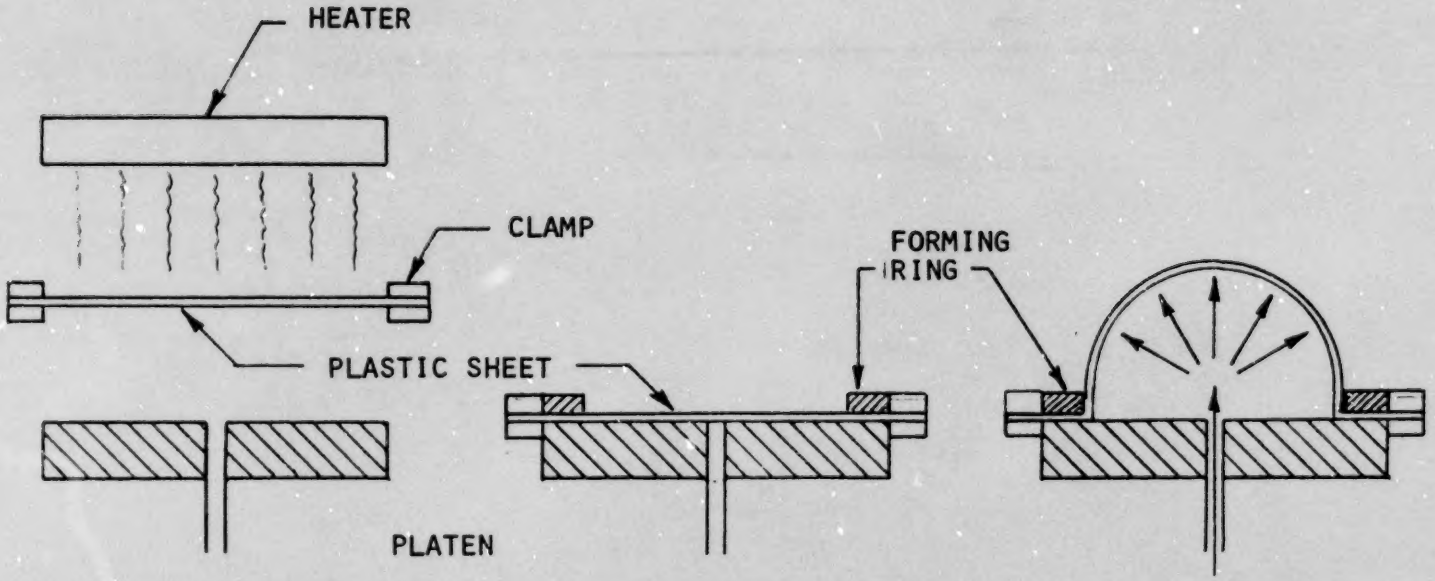
PLASTIC HEATING

SHEET AND PRESSURE BOX LOWERED

AIR PRESSURE APPLIED

PL7-13

FREE BLOWING

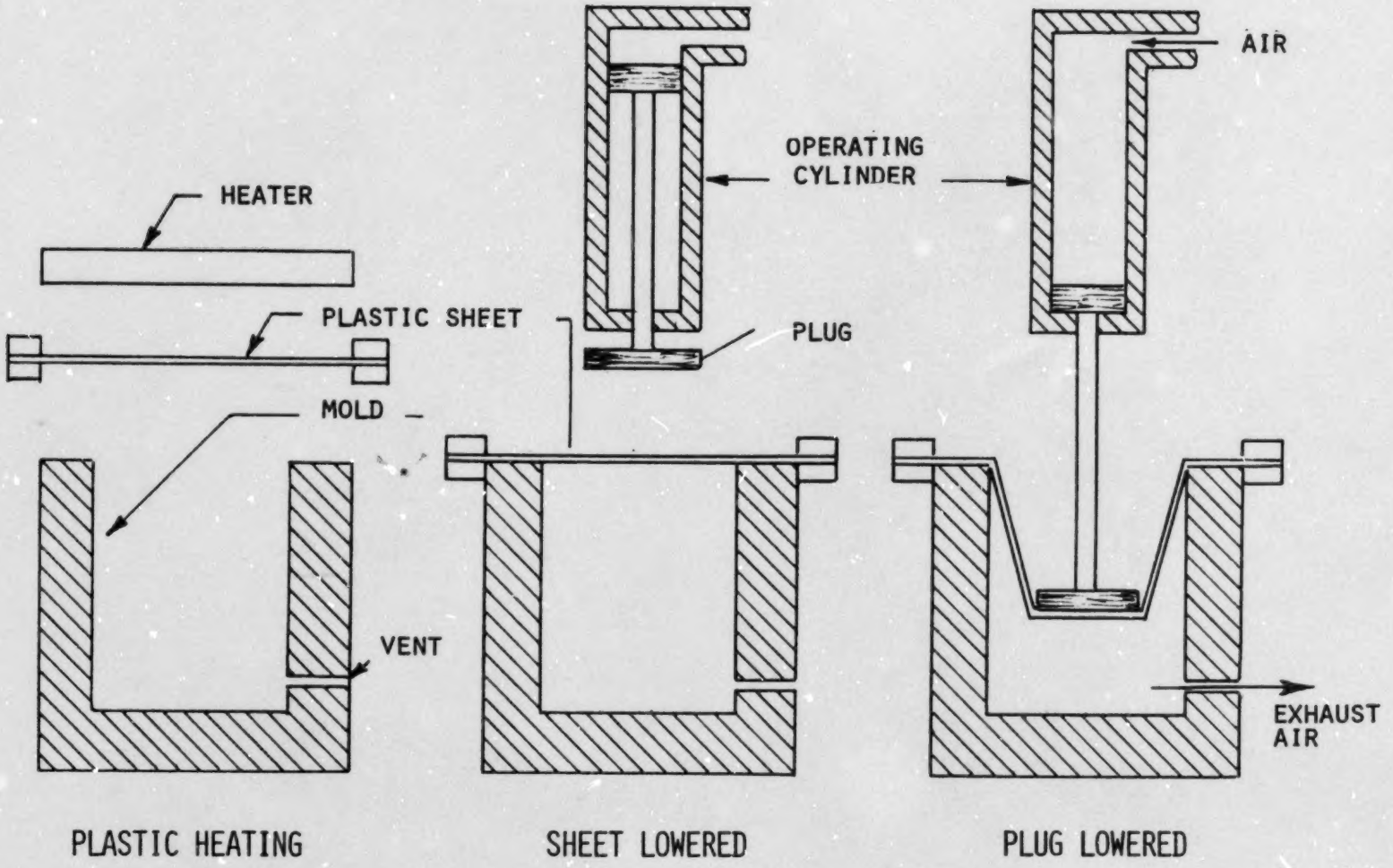


HEATING PLASTIC

PLASTIC SHEET LOWERED
FORMING RING APPLIED

AIR PRESSURE
APPLIED

PL7-14

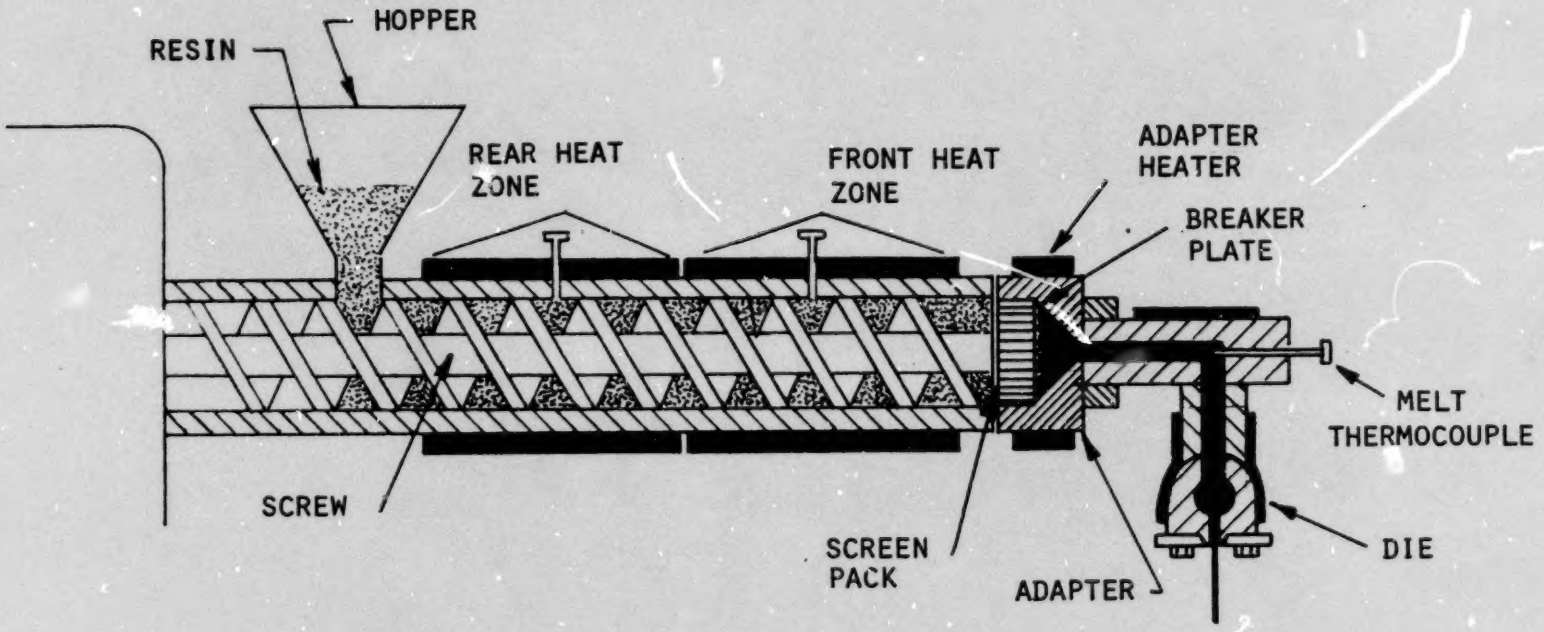


PL7-15

MECHANICAL STRETCH FORMING

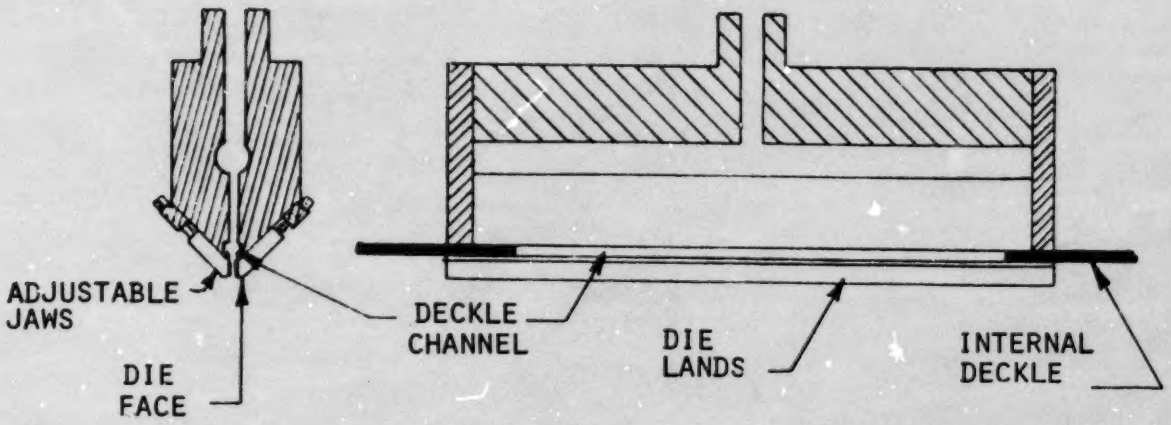
OPERATIONAL SEQUENCES FOR THERMOFORMING

1. MOUNT MOLD
2. CLAMP AND HEAT PLASTIC
3. MAKE CONTACT BETWEEN PLASTIC AND MOLD
4. APPLY PRESSURE OR VACUUM
5. COOL PART
6. REMOVE PART
7. TRIM PART

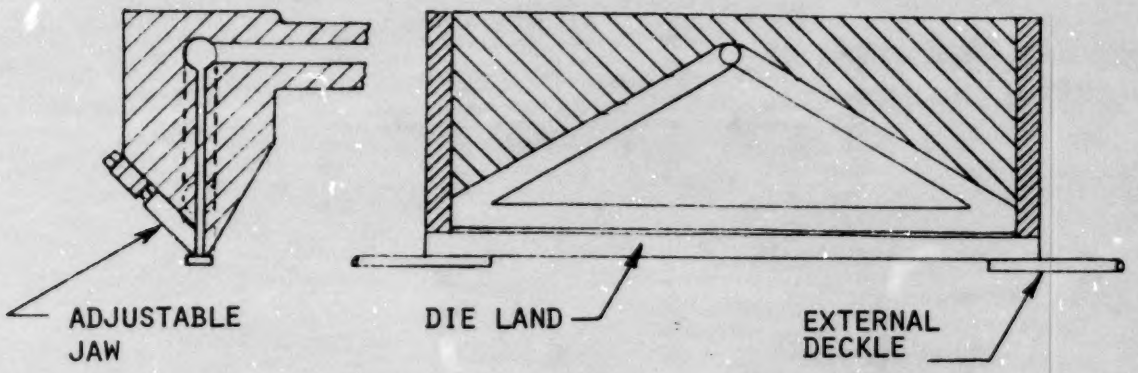

HOPPER
RESIN
REAR HEAT ZONE
FRONT HEAT ZONE
ADAPTER HEATER
BREAKER PLATE
MELT THERMOCOUPLE
SCREW
SCREEN PACK
ADAPTER
DIE

EXTRUDER

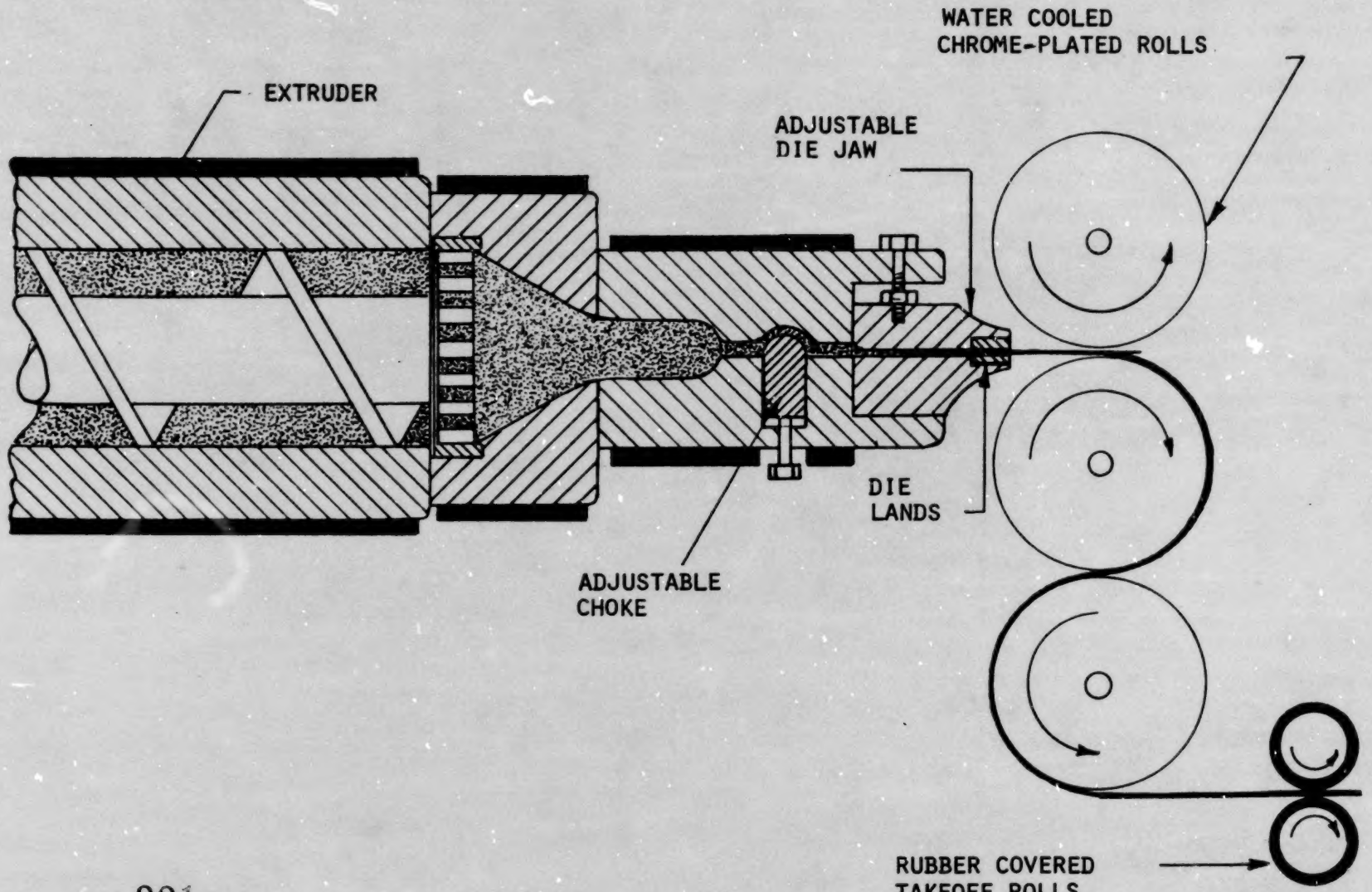
"T"-TYPE DIE



COAT HANGER DIE

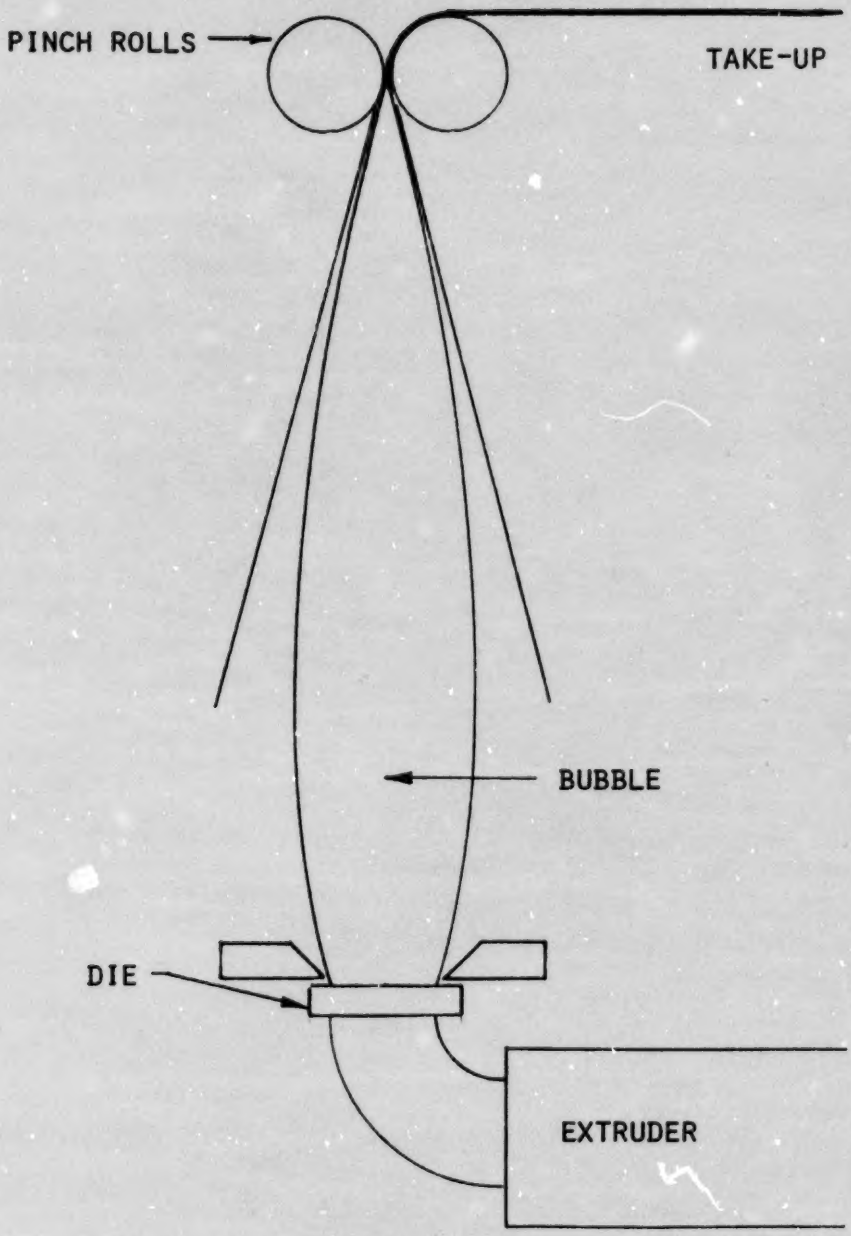


SHEET AND FILM DIES

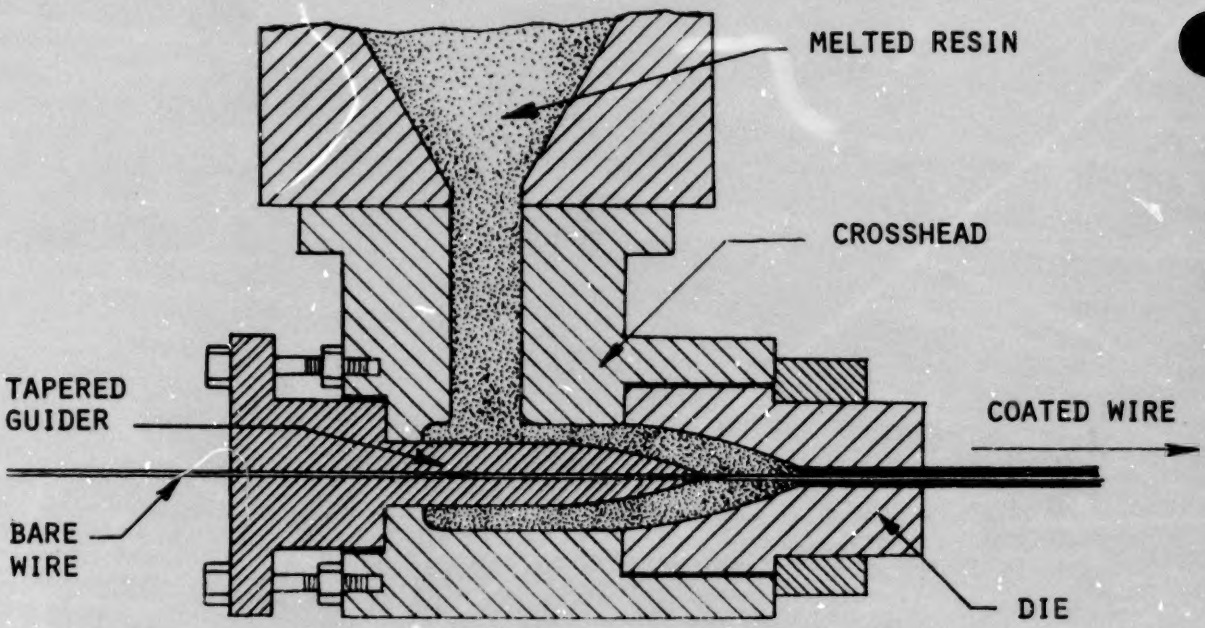


PL7-19

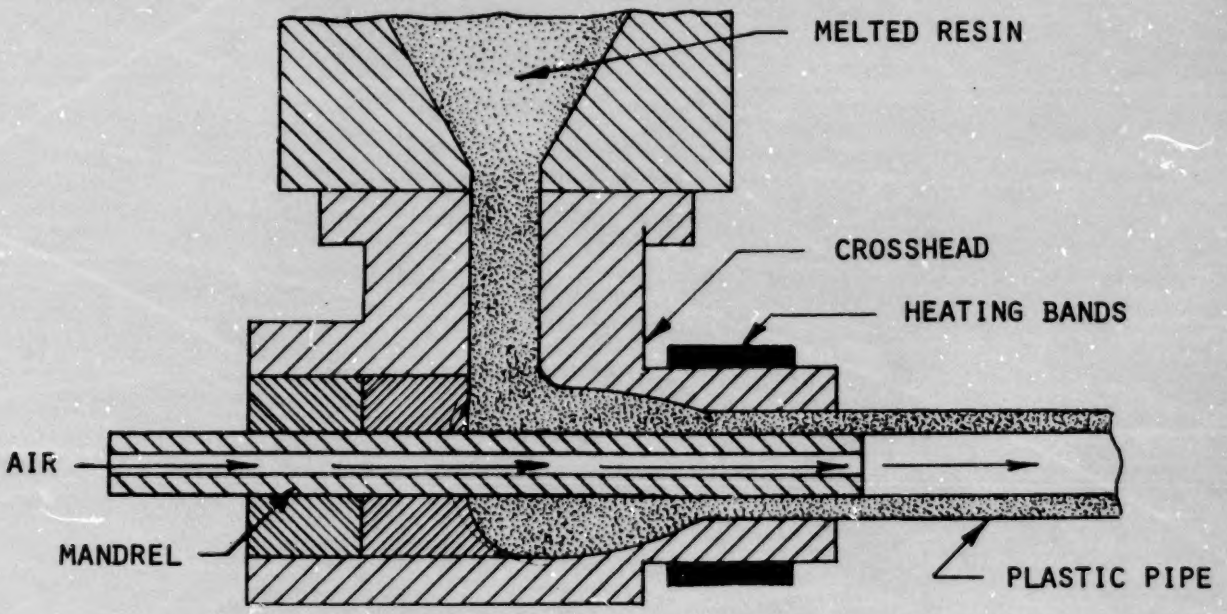
SHEET EXTRUSION



BLOWN FILM EXTRUSION



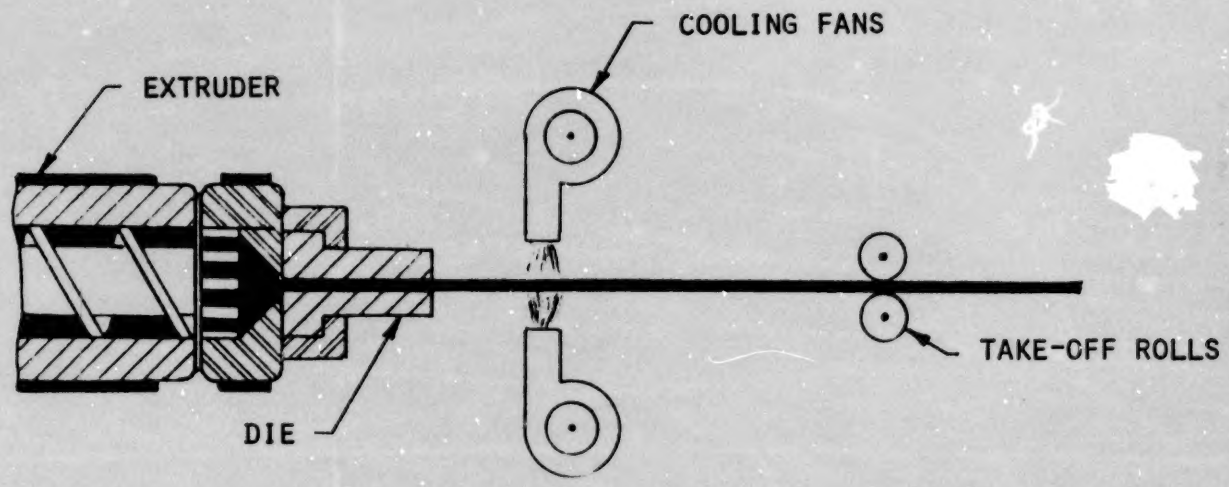
CROSSHEAD WIRE COATING DIE



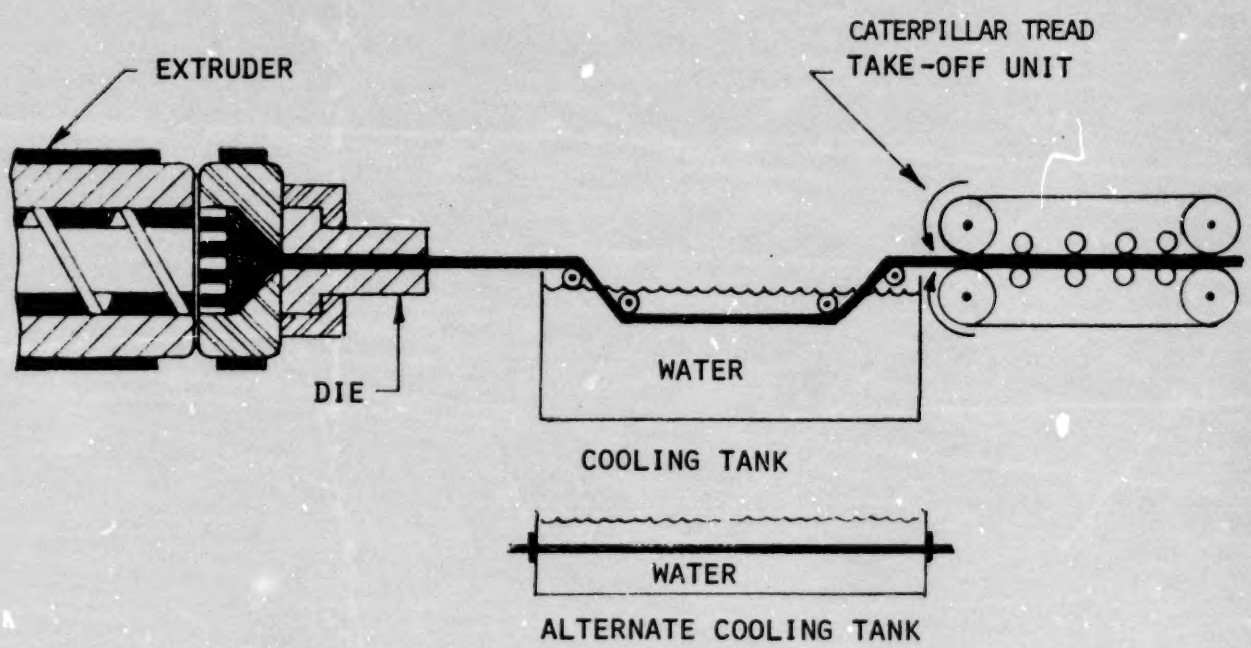
HOLLOW MANDREL PIPE/TUBING DIE

TUBING AND WIRE COATING DIES

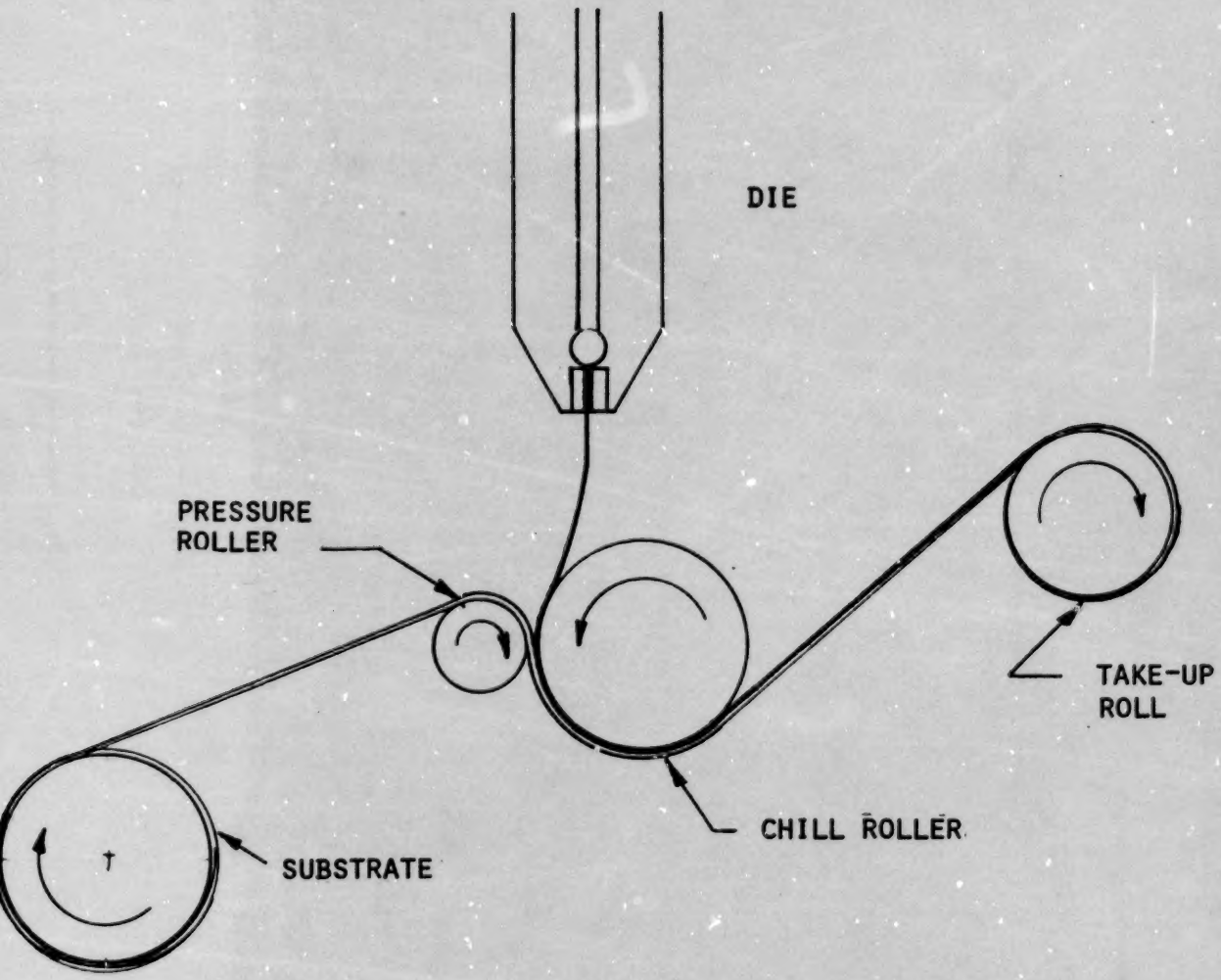
TAKE-OFF SECTIONS



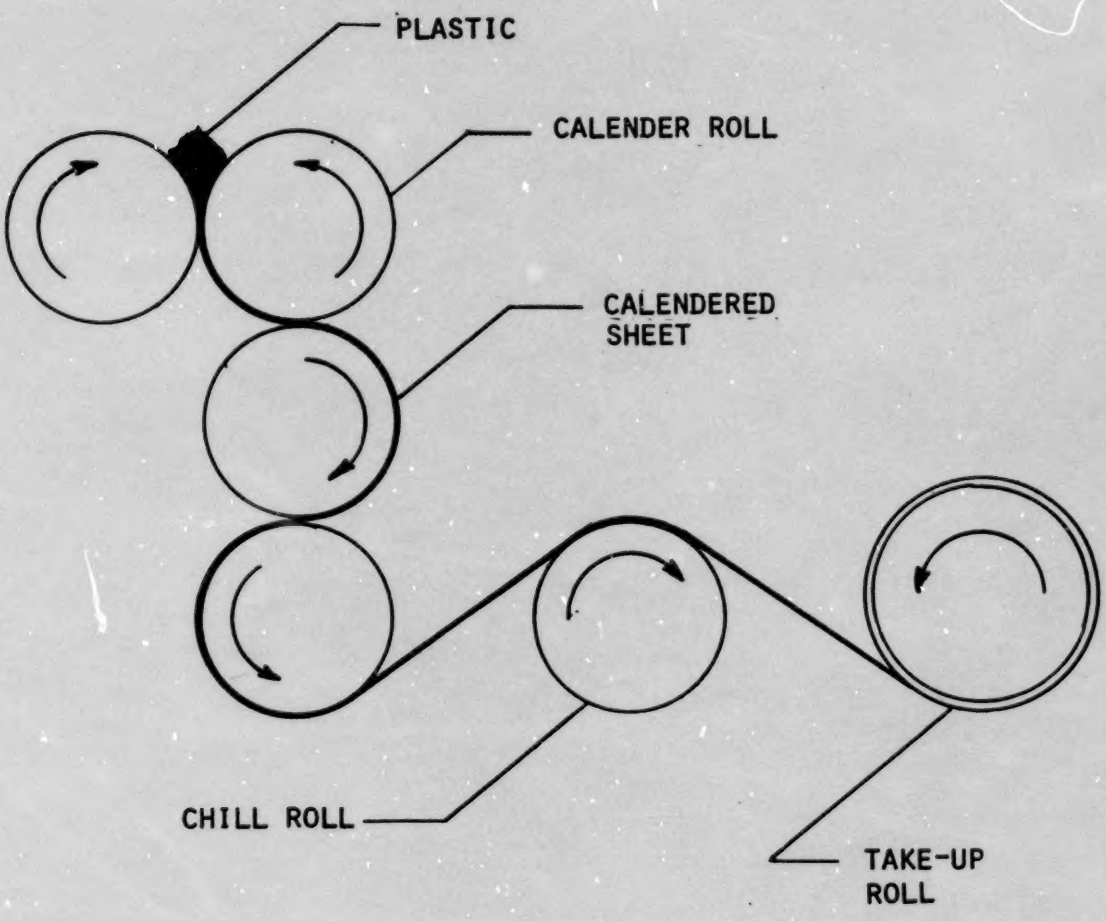
ROD & PROFILE EXTRUSION W/ PINCH ROLL TAKE-OFF



ROD EXTRUSION W/ WATER QUENCH & CATERPILLAR TREAD TAKE-OFF UNIT



EXTRUSION COATING



CALENDERING

BONDING

- ADHESION
  - BODIED ADHESIVES
  - ELASTOMERIC ADHESIVES
  - REACTIVE ADHESIVES
- COHESION
  - SOLVENT CEMENTS
  - MONOMERIC CEMENTS
- HEAT SEALING
  - THERMAL
  - IMPULSE
  - ULTRASONIC
  - DIELECTRIC
- WELDING
  - HOT GAS
  - SPIN
  - HOT PLATE
  - ULTRASONIC
  - HOT WIRE
  - INDUCTION

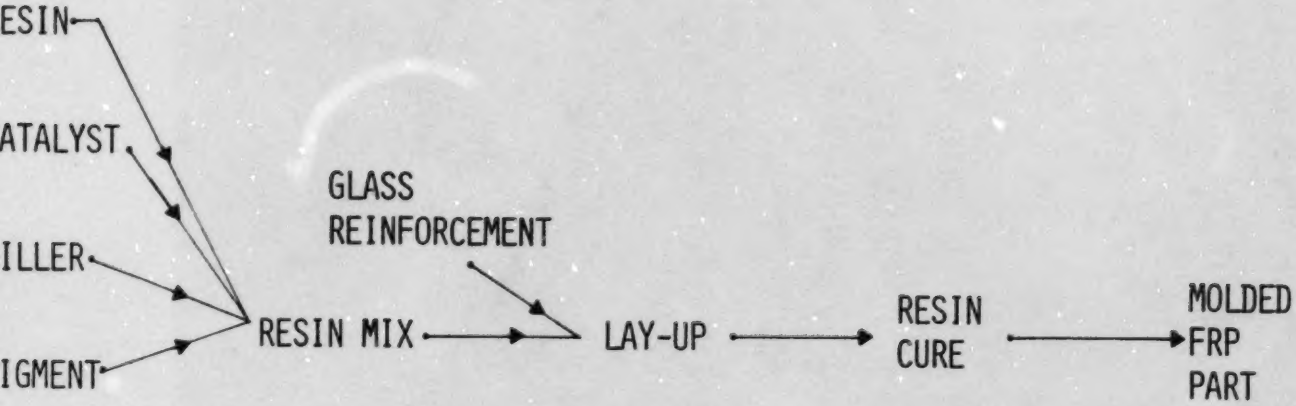
LAMINATING

LOW PRESSURE

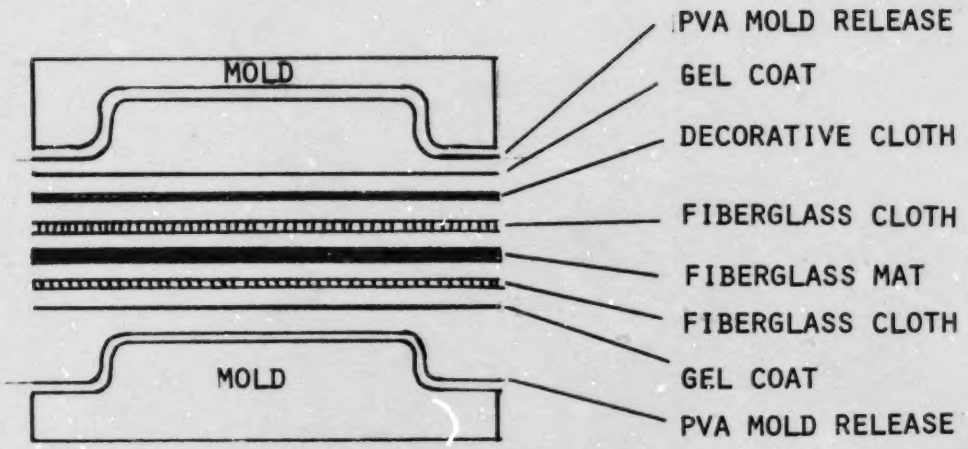
- 0-1000 PSI (POUNDS PER SQUARE INCH)
  - FIBERGLASS-REINFORCED PLASTIC (FRP)
  - THERMOPLASTIC LAMINATION
  - COMPREG LAMINATION

HIGH PRESSURE

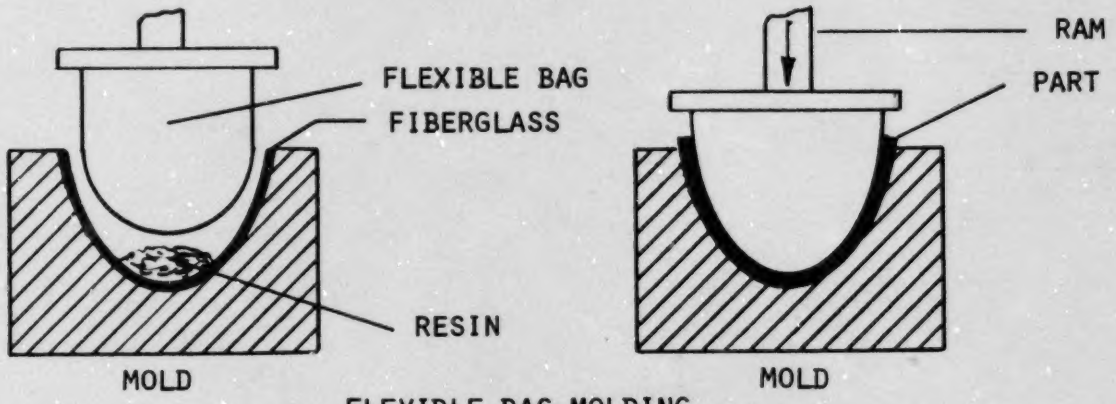
- OVER 1000 PSI
  - THERMOSET LAMINATION



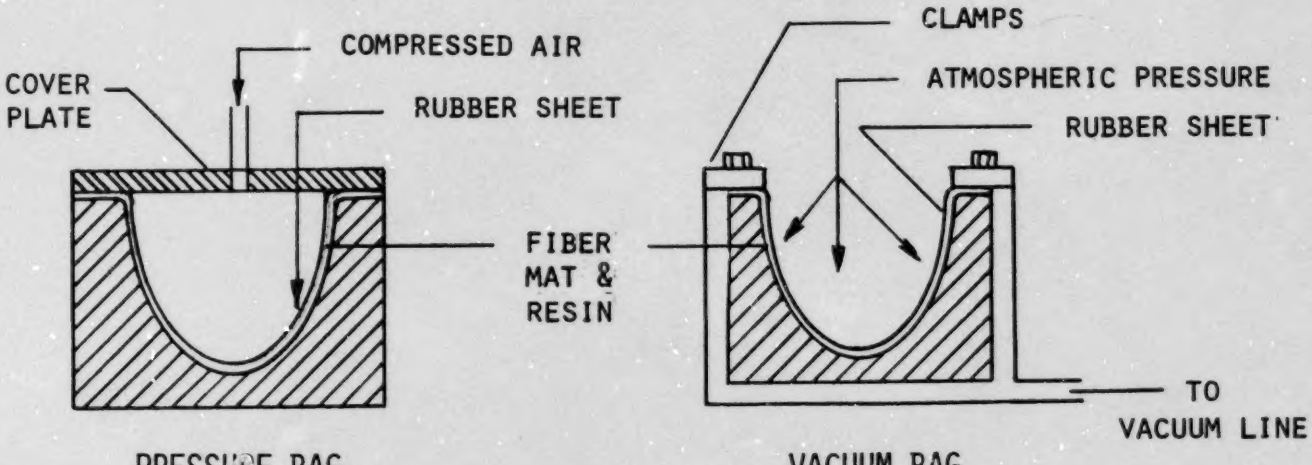
FIBERGLASS LAY-UP
FLOW CHART



MATCHED DIE MOLDING

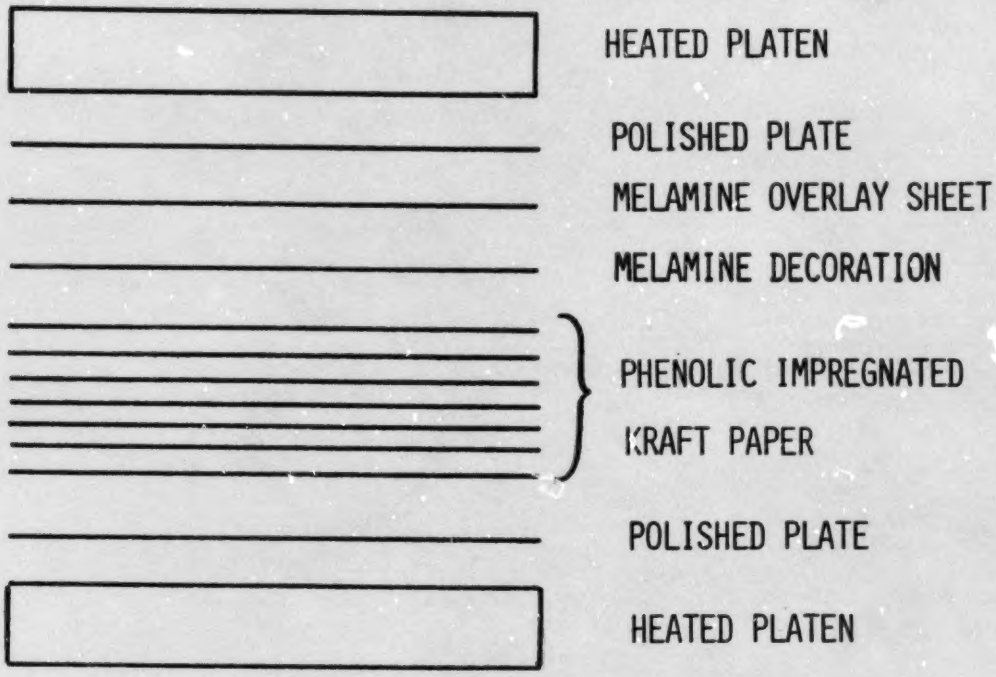


FLEXIBLE BAG MOLDING



PRESSURE BAG

VACUUM BAG



HIGH-PRESSURE LAMINATION

CASTING

THERMOPLASTIC - HEATED MOLD

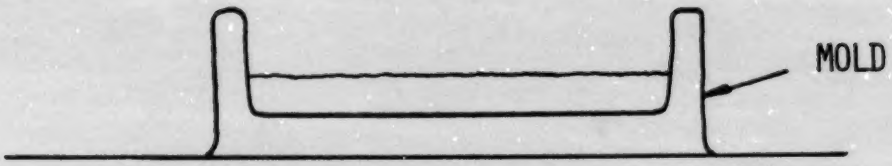
PLASTISOL CASTING

THERMOSET - CATALYST

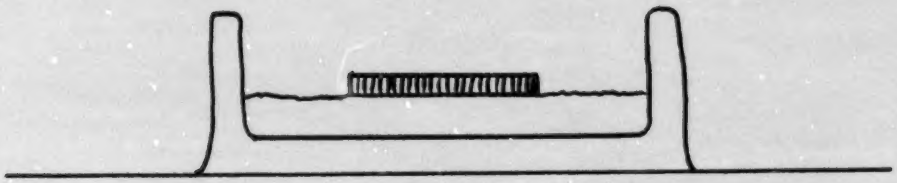
ENCAPSULATION

CAST PRODUCTS

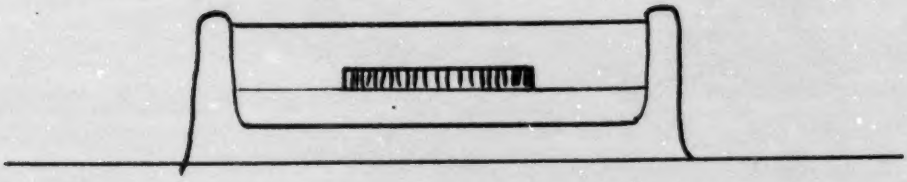
ENCAPSULATION



FIRST LAYER POURED



OBJECT PLACED IN MOLD



MOLD FILLED

EXPANSION METHODS

MECHANICAL

AGITATION

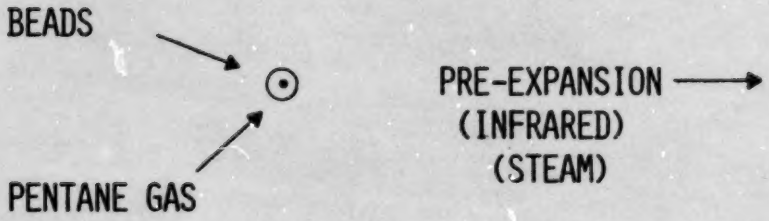
PHYSICAL

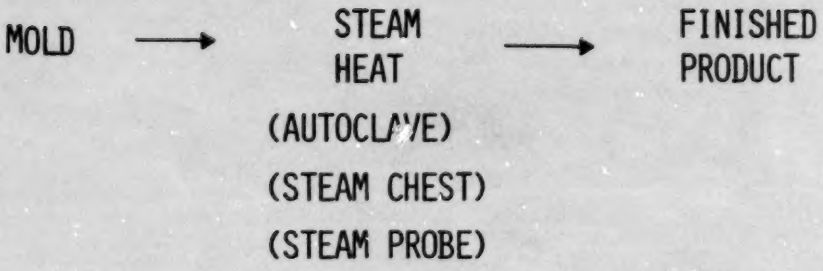
GAS ADDED

CHEMICAL

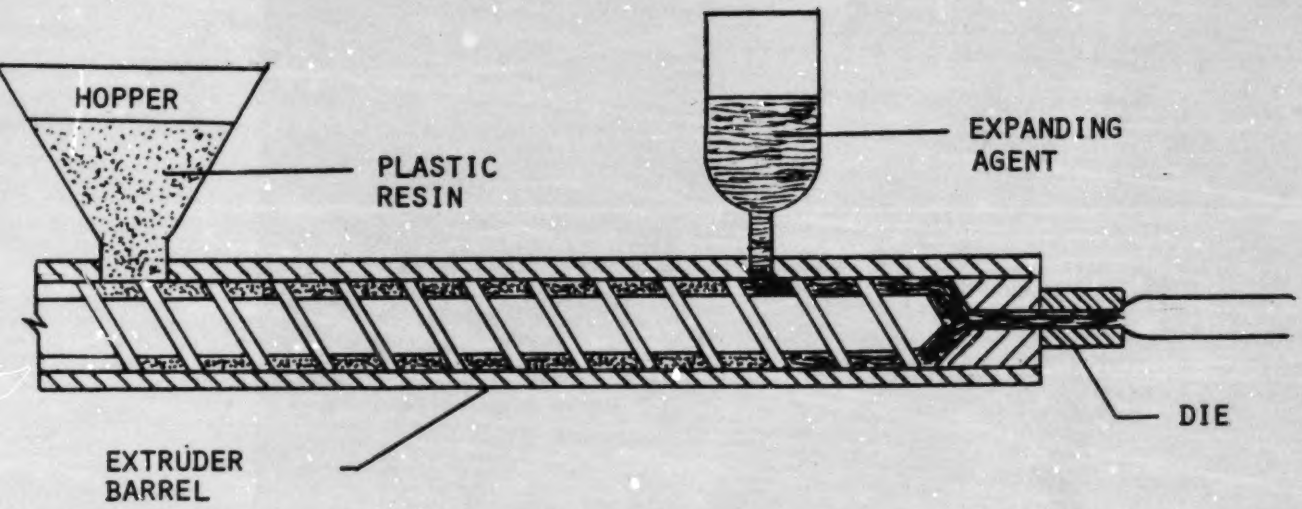
REACTION FORMS GAS

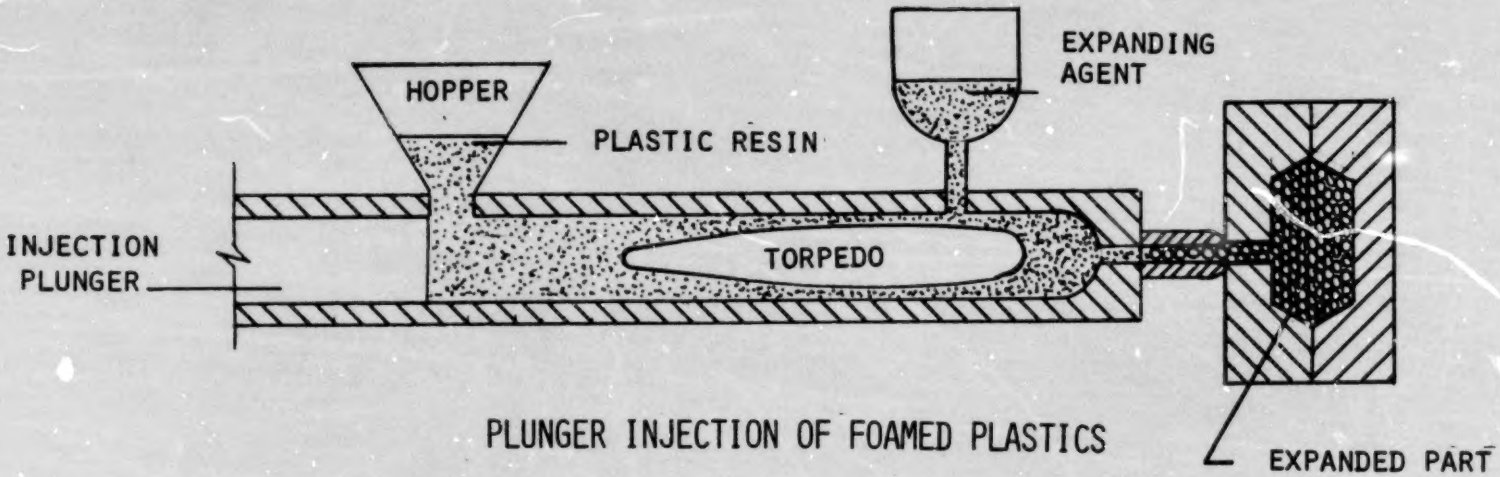
EXPANDABLE BEADS



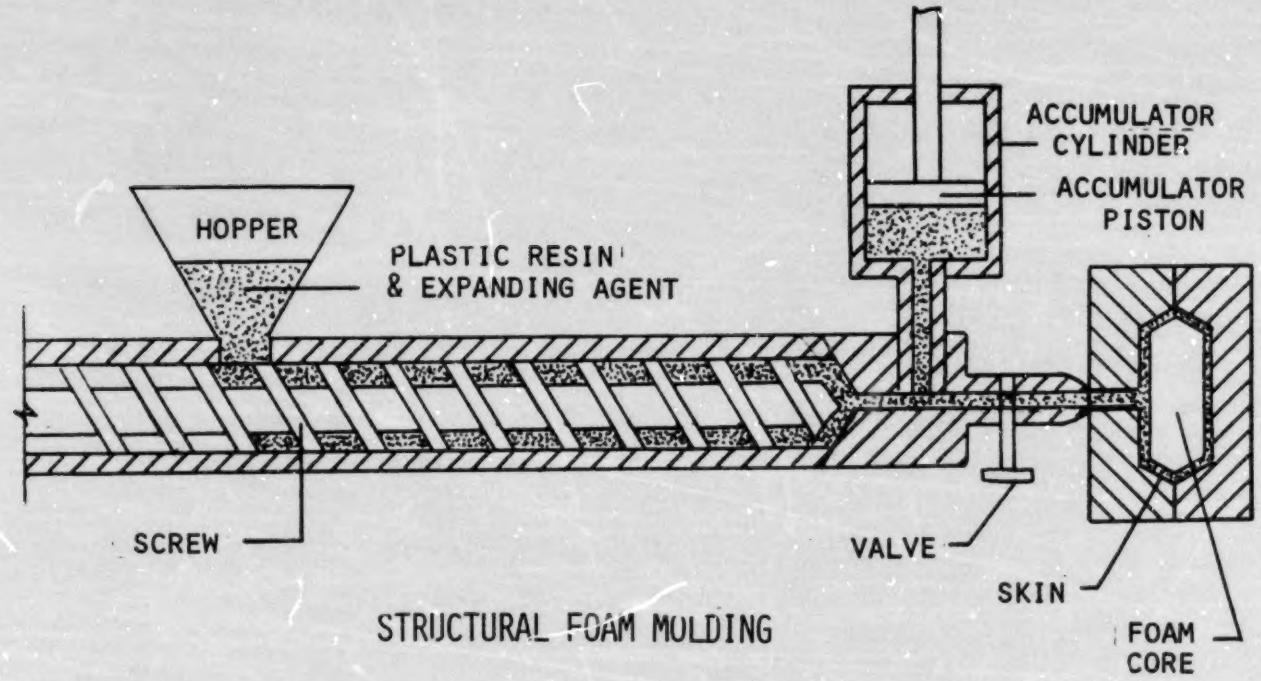


SCREW EXTRUSION OF PLASTIC FOAM





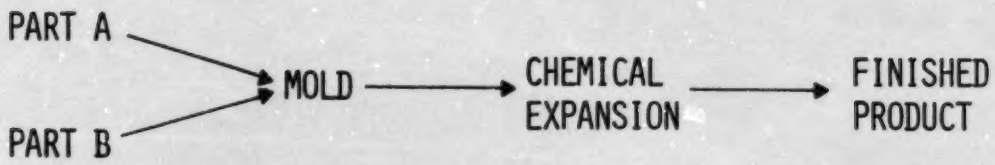
PLUNGER INJECTION OF FOAMED PLASTICS

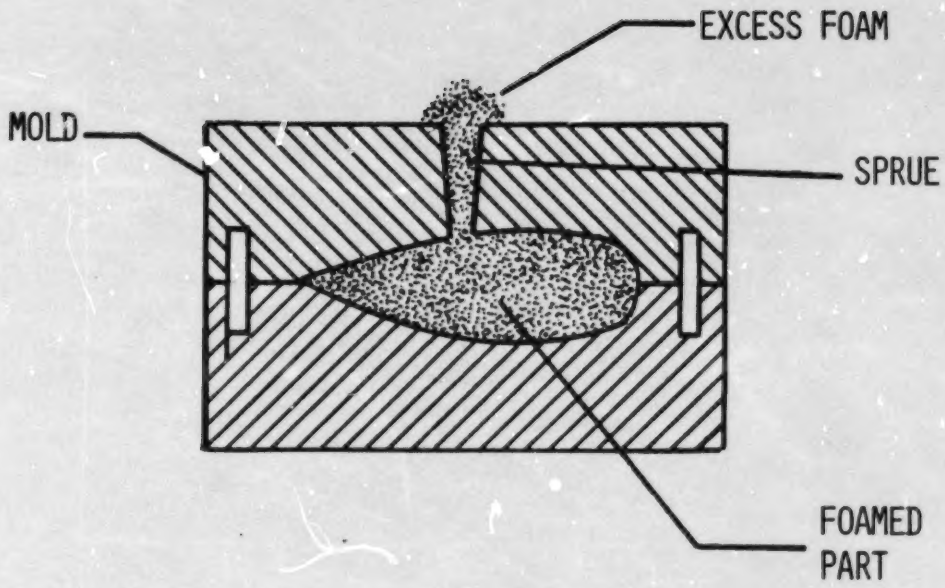


STRUCTURAL FOAM MOLDING

PL7-34B

POLYURETHANE FOAM





THERMOFUSION

ROTATIONAL MOLDING (DYNAMIC PROCESSES)

- SINGLE AXIS
- TWO AXIS
- CENTRIFUGAL

STATIC PROCESSES

- DIP MOLDING
- DIP COATING
- SLUSH MOLDING
- STATIC POWDER MOLDING

OPERATIONAL SEQUENCE
FOR
ROTATIONAL MOLDING

PREHEAT THE OVEN

APPLY MOLD RELEASE

FILL AND CLOSE MOLD

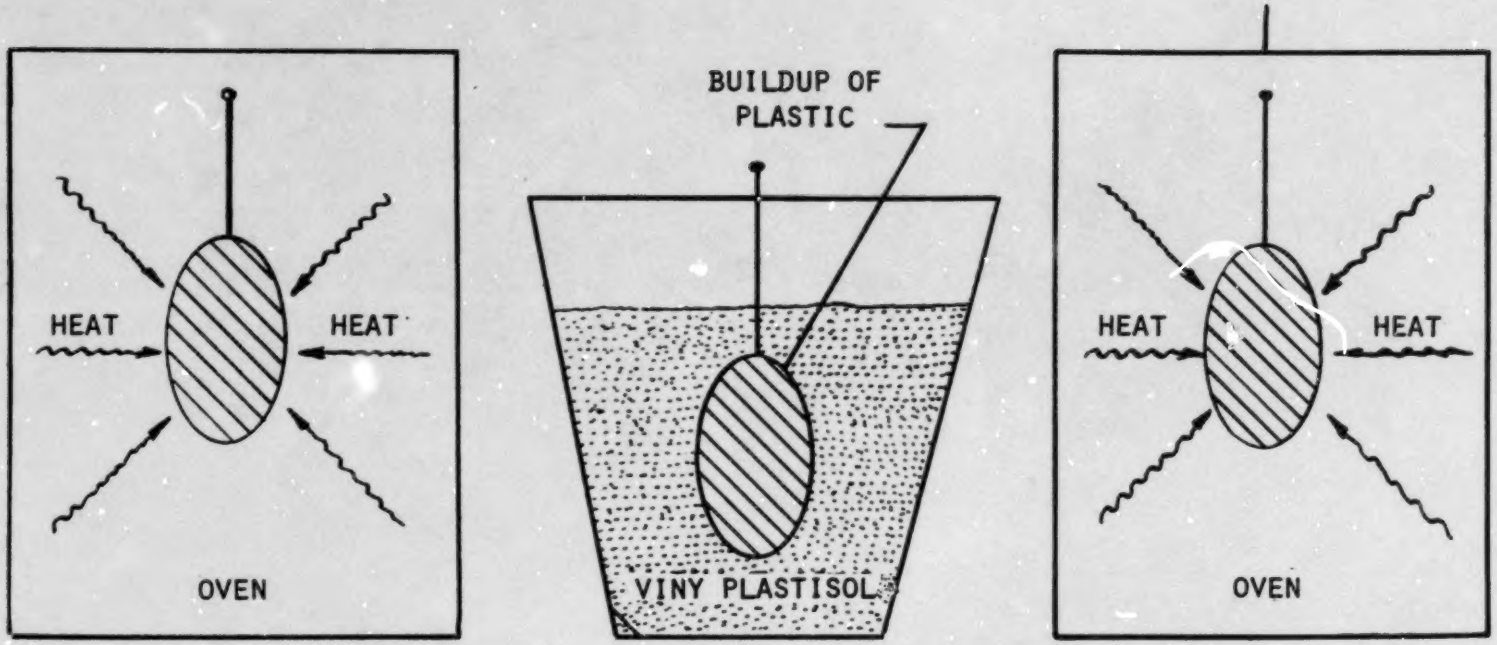
PLACE IN OVEN

START MOLDER

COOL THE MOLD

OPEN THE MOLD

REMOVE THE PART

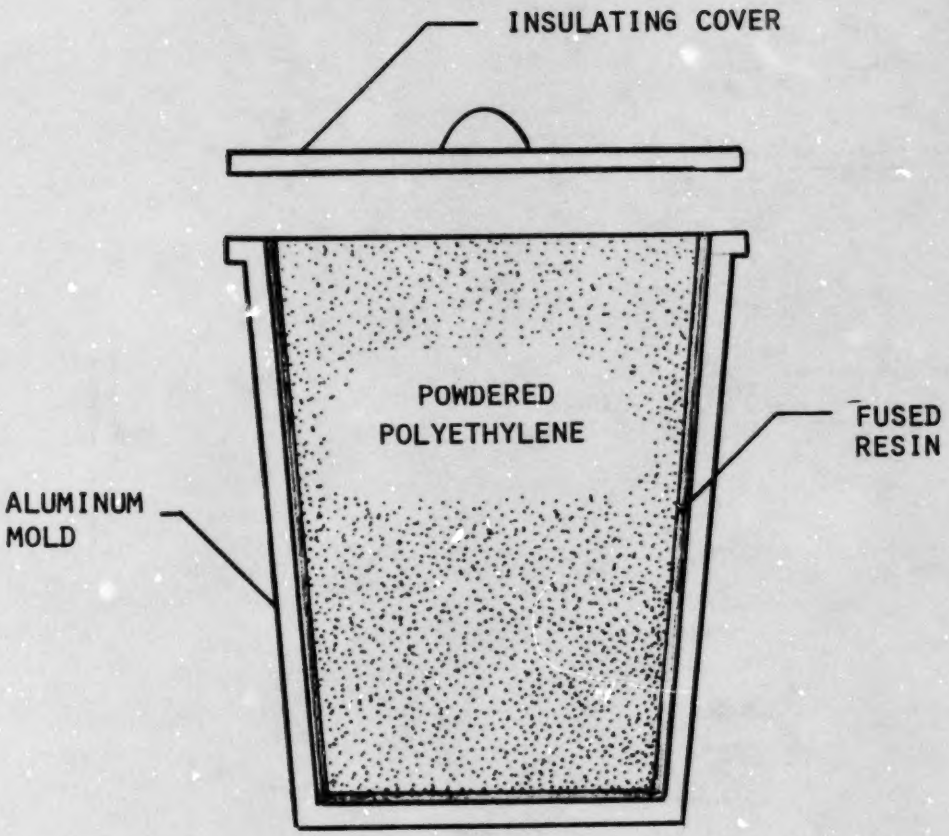


PL7-38

243

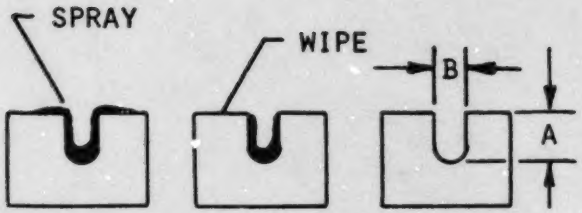
DIP CASTING

244



STATIC MOLDING

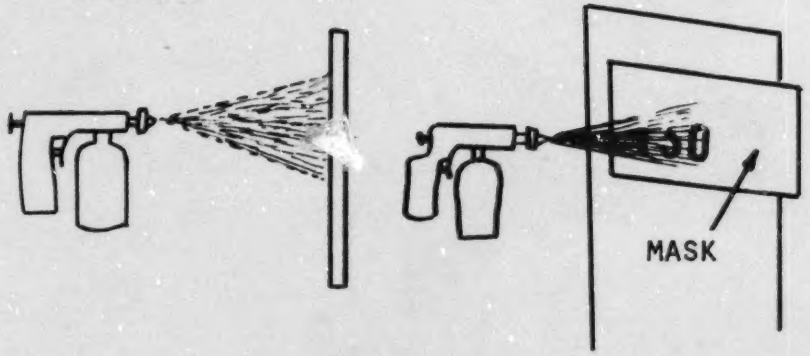
SPRAY & WIPE



A = 1½ B

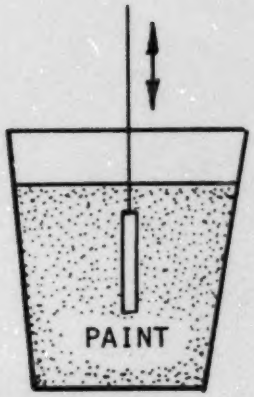
SPRAYING

MASKED SPRAYING

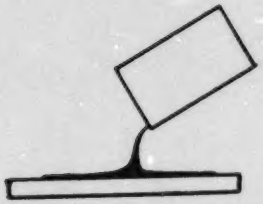


PAINTING

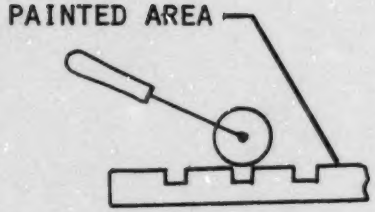
PL7-40



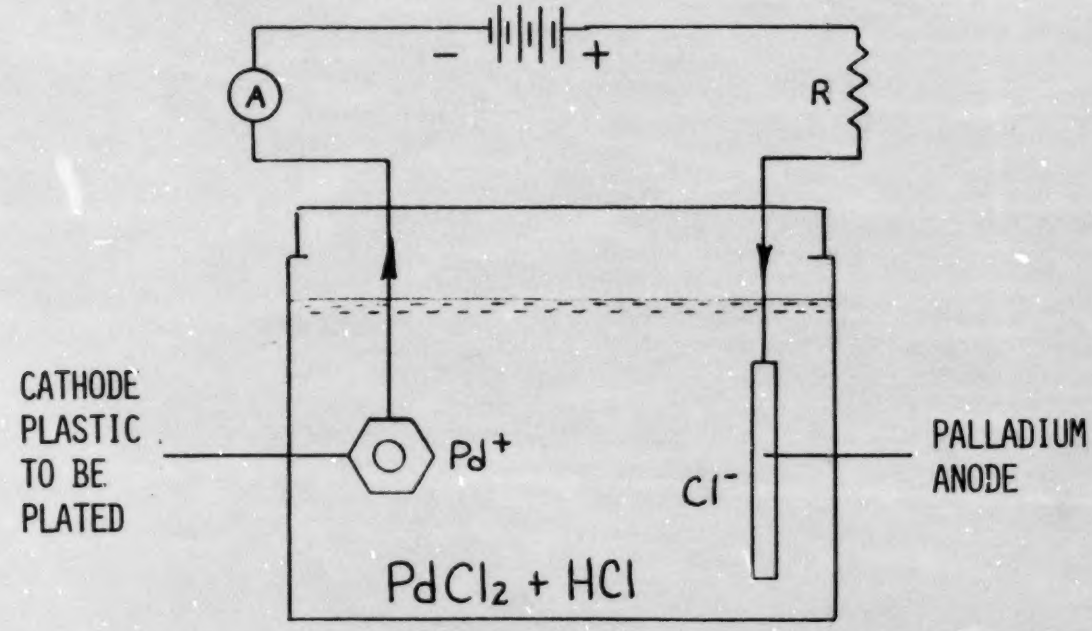
DIP COATING



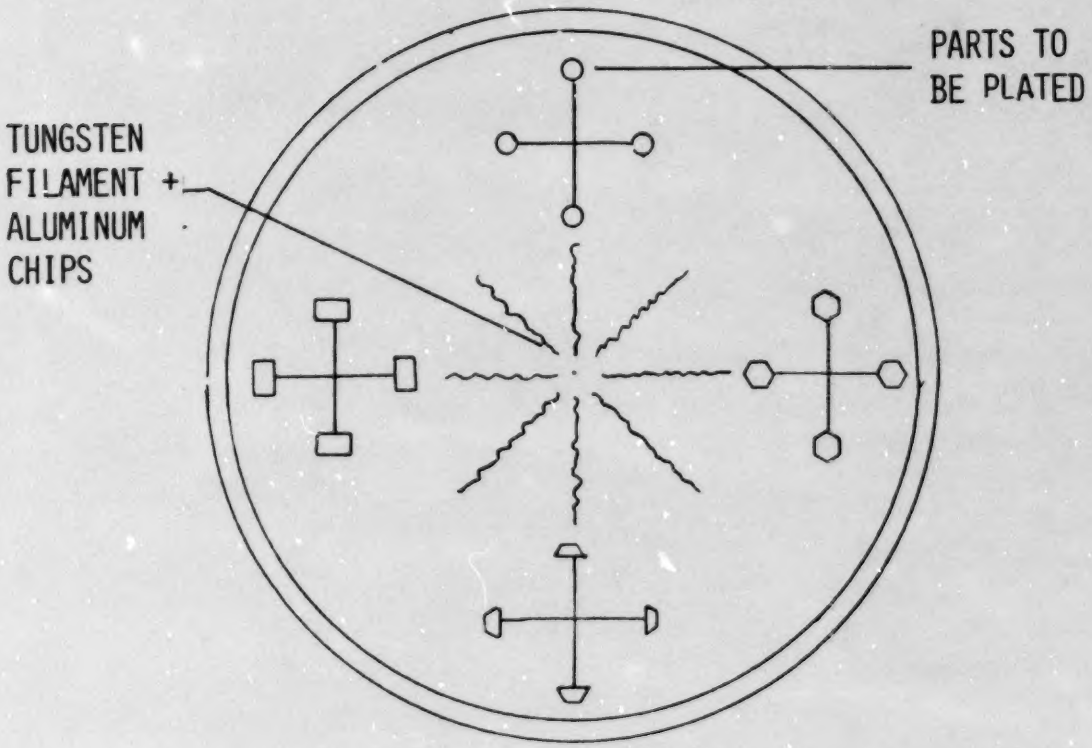
FLOW COATING



ROLLER COATING

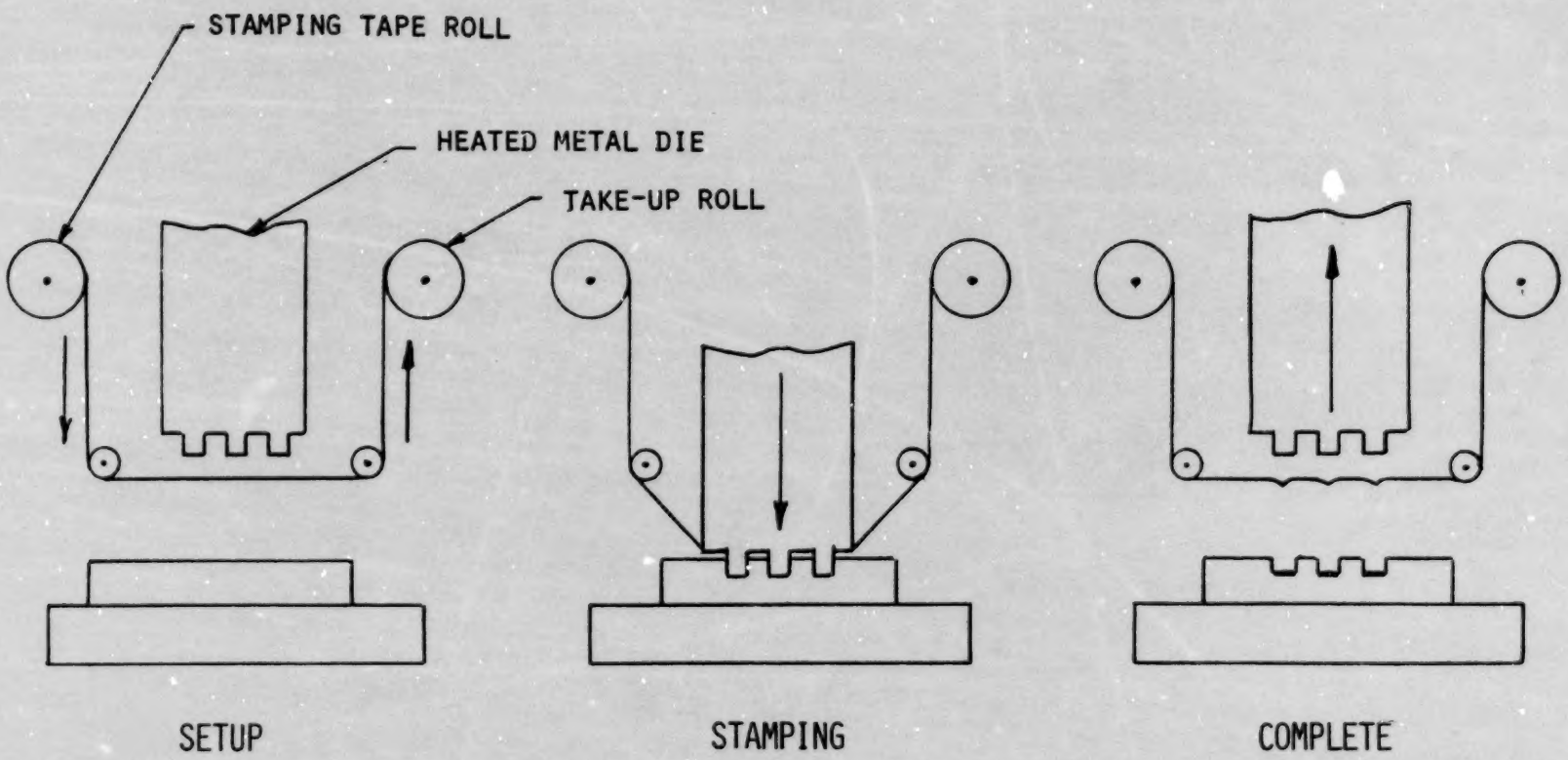


ELECTROPLATING

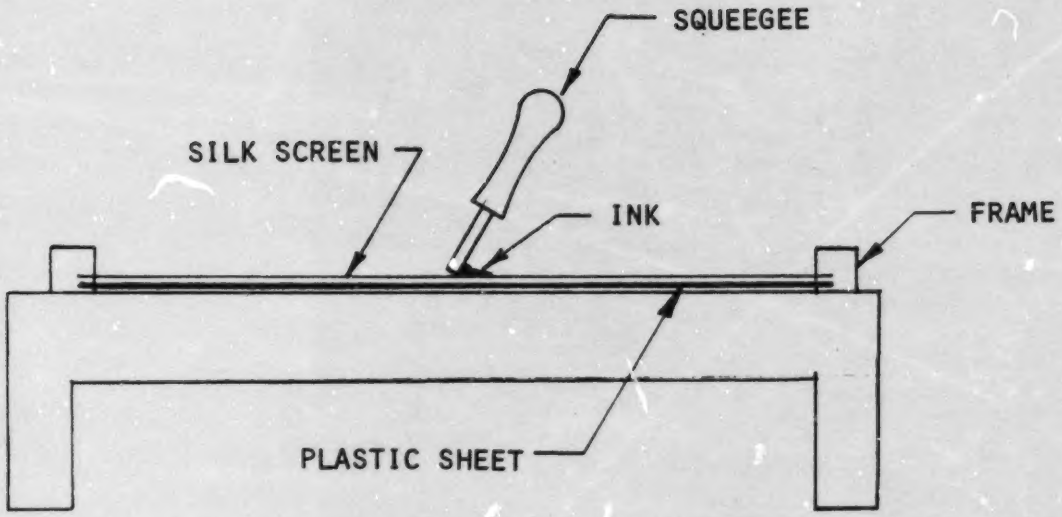


VACUUM METALIZING

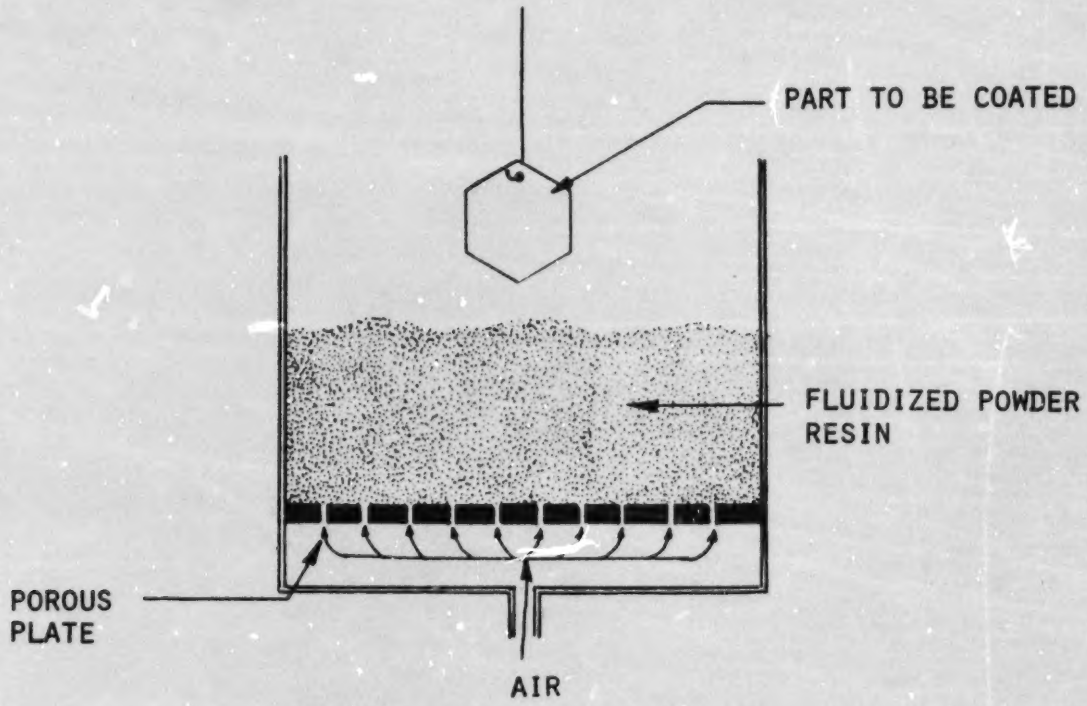
HOT FOIL STAMPING



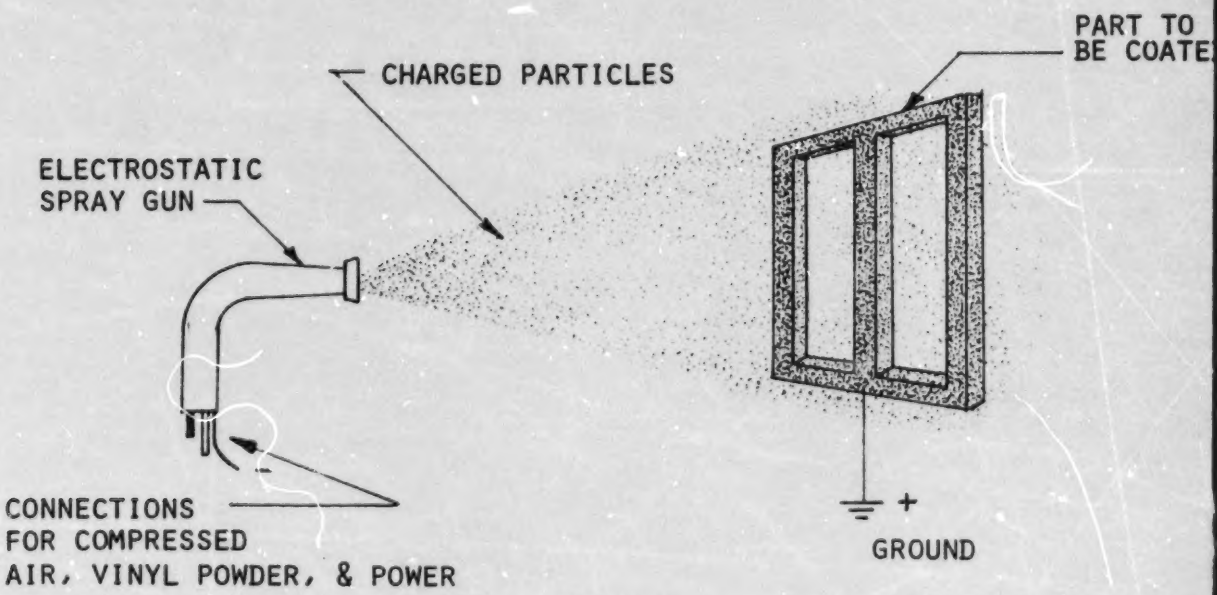
PL7-42



SILK SCREENING



FLUIDIZED BED COATING



ELECTROSTATIC SPRAY COATING

8
Career Opportunities

OBJECTIVES

After students have covered the material in this unit, they should be able to—

1. recognize the classifications of jobs in the plastics industry;
2. make informed and meaningful occupational choices regarding the plastics industry; and
3. explain the relationship that exists among the various occupational classifications and the importance of all jobs in industry.

KEY WORDS: VOCABULARY

The words in the following list may be new to the student studying plastics. Teachers should help students understand these words as they are used in this topic of study.

professional
supervisor
technician
skilled
semiskilled

TEACHING AIDS

- Overhead projector
- Films
- Filmstrips
- Slides
- Charts
- Some of the materials listed in Appendix A can be used as teaching aids when appropriate.
- Test Key: 1-A, 2-D, 3-D, 4-D, 5-D
- Transparencies: You will find transparencies PL8-1 through PL8-7 at the end of this unit. If you wish, these masters may be duplicated in quantity and given as handouts to the students while they are studying different aspects of this unit.

PL8-1: Occupational Classifications
PL8-2: Professional Occupations in Plastics
PL8-3: Supervisory Positions in Plastics
PL8-4: Technician Positions in Plastics
PL8-5: Skilled Positions in Plastics
PL8-6: Semiskilled Positions in Plastics
PL8-7: Production Chain

SUGGESTED REFERENCES

The references listed here represent only a few of those available. Other information can be obtained from the U.S. Government Printing Office, The Society of the Plastics Industry, The Society of Plastics Engineers, and The Plastics Education Foundation. Periodicals such as Plastics Technology, Plastics World, Plastics Engineering, Modern Plastics, Modern Plastics Encyclopedia, and Plastics Design and Processing are excellent

sources of information regarding all phases of the plastics industry. Trade publications are often available in classroom quantities, free of charge. Many of these trade publications contain information that can be of great assistance to teachers and students. Educational publications, such as Industrial Education, School Shop, and Technology Teacher, provide up-to-date information about teaching techniques and aids that are available to the plastics teacher.

Baird, R. J., and Baird, D. T. Industrial Plastics. South Holland, Ill.: Goodheart-Willcox Company, 1982.

Edwards, Lauton. Industrial Arts Plastics. 2nd ed. Peoria, Ill.: Charles A. Bennett Company, 1974.

Jambro, D. J. Manufacturing Processes: Plastics. Englewood Cliffs, N.J.: Prentice-Hall, 1976.

Miller, W. R., et al. Basic Industrial Arts: Plastics. Bloomington, Ill.: McKnight Publishing Company, 1978.

Steele, G. L. Exploring the World of Plastics. Bloomington, Ill.: McKnight Publishing Company, 1977.

SENTENCE OUTLINE

I. The plastics industry
   This is one of the fastest-growing industries in the world:
   A. The broadness and diversification of the plastics industry requires a wide variety of occupational specialists to support it.
   B. As the plastics industry continues to develop in the future, new occupations and specializations that have not yet been defined will be required.

II. Occupational classifications
   Occupations within the plastics industry fall within the following classifications: professionals, supervisors, technicians, skilled workers, and semiskilled workers. (Transparency PL8-1)
   A. Professional occupations require specialized knowledge and formal education. (Transparency PL8-2)
      1. Chemical engineers work to develop new types of plastics and processes, solve problems concerned with mixing and blending of plastics materials, and work with flow patterns and quality control.
      2. Mechanical engineers design machines, tools, molds, and dies. They also establish maintenance schedules for equipment, plan production schedules, and supervise the installation of new equipment.
      3. Research chemists develop new plastics materials, test properties of different types of plastics, and work with engineers to develop usable compounds.
      4. Design engineers develop new products and work with chemical and mechanical engineers to develop new processes and new production equipment.
      5. Sales personnel work in all phases of the plastics industry, selling raw materials, equipment, and products.
      6. Educators with a strong background in plastics work in public schools, technical schools, universities, and industries to teach students about the plastics industry and to train personnel for industrial occupations.
   B. Supervisors are used in all aspects of the plastics industry and should have a general knowledge of all phases of the industry. Most supervisory positions require actual work experience in the area to be supervised, as well as some formal education. (Transparency PL8-3)
      1. Plant managers and production managers supervise the overall production of the product from raw material to finished product.
      2. Other supervisory positions include line supervisors, sales managers, personnel managers, inventory control, and quality control supervisors.

C. Technicians are needed in many areas of the plastics industry. They must have an overall knowledge of the industry, as well as formal training and specialized knowledge and skills in some particular area of the plastics industry. (Transparency PL8-4)
   1. Technicians are required in the areas of materials testing, quality control, equipment maintenance, troubleshooting, and other specialized phases of the plastics industry.
   2. Computer programming technicians are needed to program computer-controlled mixing operations, climate control, inventory control, shipping, receiving, billing, and other areas.
   3. Highly trained numerical control programmers are required to program CNC production and machining equipment, as well as robots used in the production process.

D. Skilled workers are needed in many phases of plastics production. Many skilled workers are machinists who have received their training in technical schools and through industrial training programs. (Transparency PL8-5)
   1. Many skilled workers serve as tool and die makers, mold makers, and machinists.
   2. Other skilled personnel serve as setup workers who mount dies and molds and adjust machines prior to production runs.

E. The largest group of employees in the plastics industry includes the semiskilled workers. Most semiskilled workers are trained on the job and have little technical training or formal education. (Transparency PL8-6)
   1. Semiskilled workers are employed as machine operators, assemblers, and finishers in the production area.
   2. Other semiskilled workers serve as material handlers, transporters, shipping personnel, and inspectors.

III. Development of the plastics industry

The development and manufacturing of plastics products requires a cooperative effort among many people with different levels of education, training, and skills. Each worker is vital to the success of the product, and all of the manufacturing processes should be considered of equal importance. (Transparency PL8-7)

MATERIALS FOR STUDENTS

- Vocabulary worksheet
- Poster board or paper
- Marking pens
- Newspapers
- College and technical school catalogs

SUGGESTED STUDENT ACTIVITIES

1. Select a complex product made of plastic, and chart its development from concept to finished product. List the job titles of workers involved in the product during each stage of development and production.
2. Survey the "Help Wanted" section of large city newspapers to determine the employment opportunities available in the plastics industry. List job titles, training and education required, qualities desired by the employer (if given), and amount of experience required.
3. Select an occupation from each classification, research it, and prepare a three-minute presentation to be given in class.

Vocabulary Worksheet

1. professional

2. supervisor

3. technician

4. skilled

5. semiskilled

TEST

Unit 8: Career Opportunities

Directions: Read each statement carefully. Select the word or phrase that correctly answers or completes the statement, and write the appropriate letter in the blank.

Example: C 21. The class that you are in is—

A. American Government
B. Language Arts
C. Industrial Arts
D. General Science

___ 1. A person responsible for developing new types of plastic would probably be classified as a—

A. professional
B. supervisor
C. technician
D. skilled laborer

___ 2. A skilled machinist might find work in the plastics industry as a—

A. finisher
B. material transporter
C. shipping clerk
D. mold maker

___ 3. The most important link in the production chain is the—

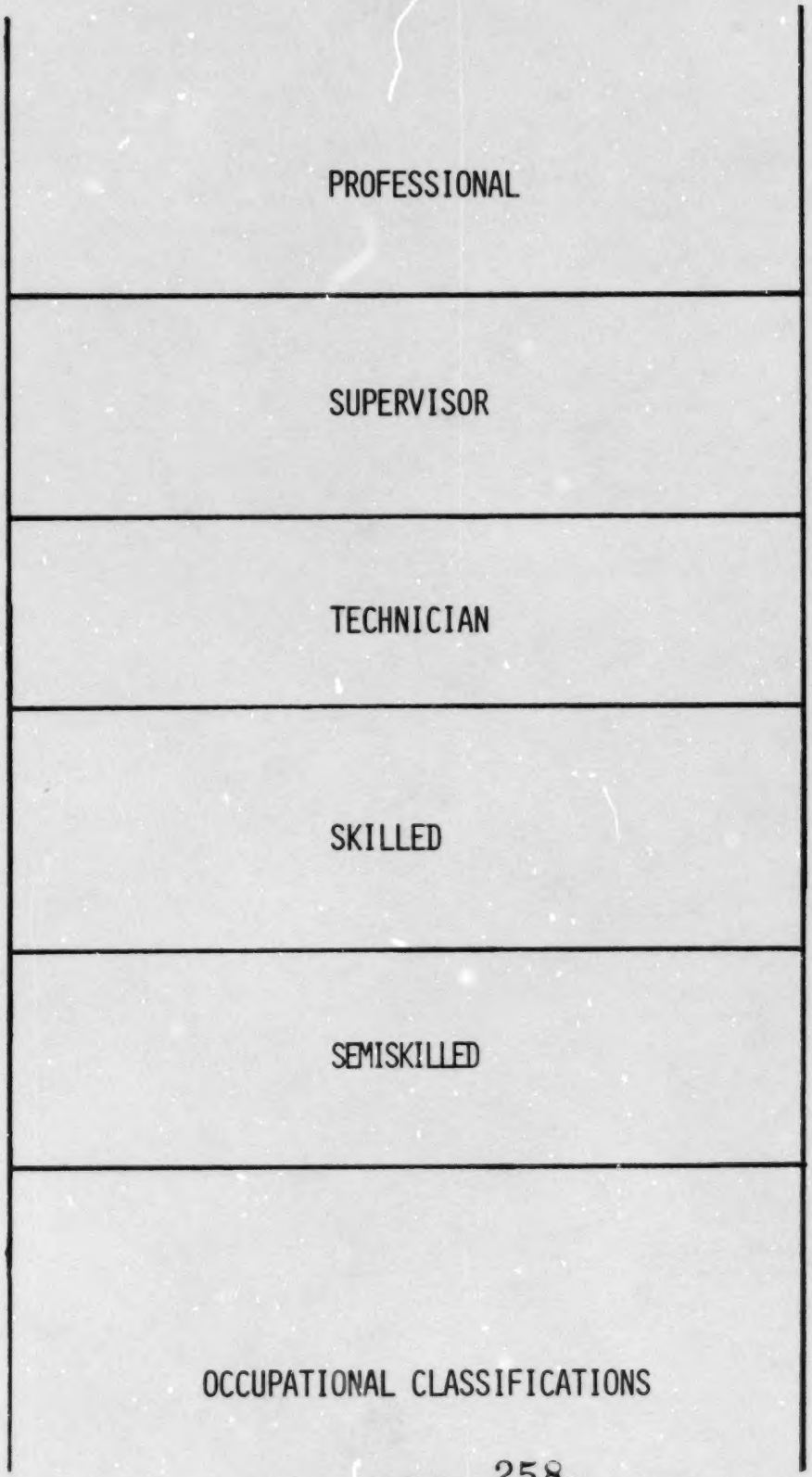
A. professional
B. technician
C. skilled worker
D. all of the above

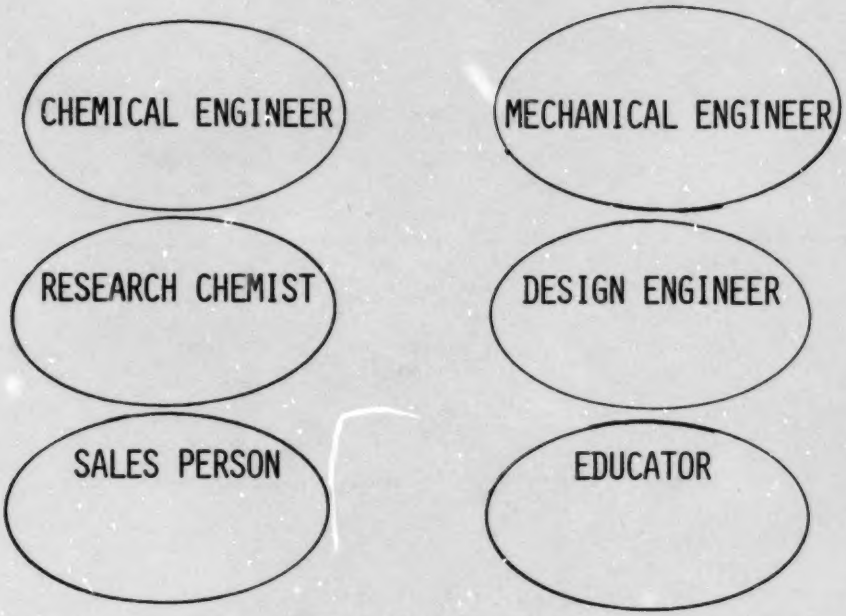
___ 4. Computer programmers are needed in the plastics industry to program—

A. CNC equipment
B. mixing equipment
C. material-handling equipment
D. all of the above

___ 5. The largest group of employees in the plastics industry includes—

A. professionals
B. supervisors
C. skilled workers
D. semiskilled workers


PROFESSIONAL
SUPERVISOR
TECHNICIAN
SKILLED
SEMISKILLED
OCCUPATIONAL CLASSIFICATIONS



PROFESSIONAL OCCUPATIONS
IN PLASTICS

PLANT MANAGER

PRODUCTION MANAGER

LINE SUPERVISOR

SALES MANAGER

PERSONNEL MANAGER

INVENTORY CONTROL

QUALITY CONTROL

SUPERVISORY POSITIONS
IN PLASTICS

MATERIALS TESTING

QUALITY CONTROL

EQUIPMENT MAINTENANCE

TROUBLESHOOTER

COMPUTER OPERATOR

COMPUTER PROGRAMMER

NUMERIC CONTROL PROGRAMMER

TECHNICIAN POSITIONS
IN PLASTICS

TOOL AND DIE MAKERS

MOLD MAKERS

MACHINISTS

SET-UP WORKERS

SKILLED POSITIONS
IN PLASTICS

MACHINE OPERATORS

ASSEMBLERS

FINISHERS

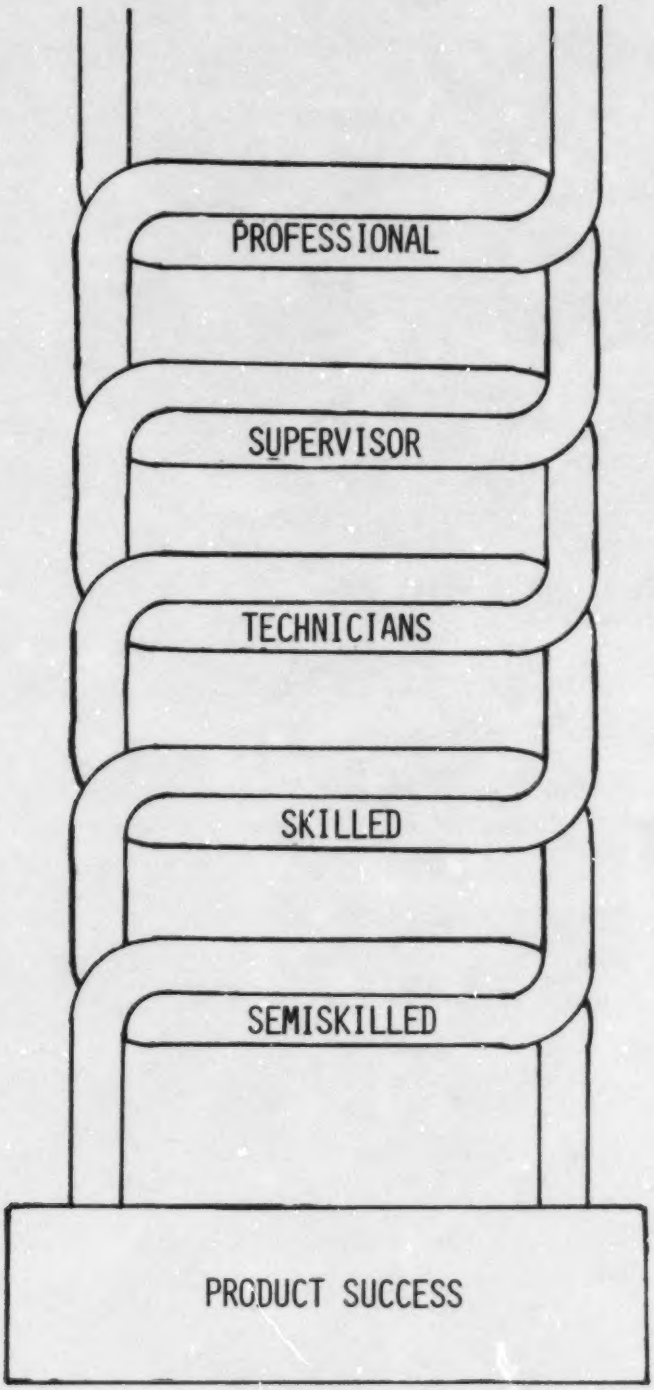
MATERIAL HANDLERS

TRANSPORTERS

SHIPPING PERSONNEL

INSPECTORS

SEMISKILLED
POSITIONS
IN PLASTICS



IF ANY LINK BREAKS, THE PRODUCTION PROCESS IS A FAILURE.

PRODUCTION CHAIN

Appendix A: Plastics Resource Materials

Films

These films may be rented at a nominal charge from many university film libraries:

Plastic Journey
Plastics from Petroleum
Plastics—Their Processing
Shape of Things to Come
All about Plastics
Born of Foam
Career Opportunities—Metal-Finishing Industries
Compression Molding, Pt. 1, Preparing the Charge and Loading the Mold
Compression Molding, Pt. 2, Molding a Simple Part
Computers at Work
Cycolac Story, The
Fiberglass
Finishing Molded Parts
Focus on Foam
Future Clear
Industrial Laminates—Key to Product Innovation
Injection Molding, Pt. 2, Cleaning and Servicing the Press
Inside Polypropylene
Inside the Injection Mold
It Started with Color
Lifetime Protection
Machining Laminated Plastics
Magic Molecule
Maintenance of Plexiglass and Lucite
Methods of Processing Plastics Materials
People and Plastics
Physical Chemistry of Polymers
Plastic Shells—How They Were Developed
Plastics
Plastics—Industrial Processes and Products
Plastics—Their Structure and Properties
Plastics in Art and Industry
Plastics Today and Tomorrow
Prospect for Plastics
Reinforced Plastics—Inspection and Quality Control
Reinforced Plastics—Introduction
Reinforced Plastics—Repair of Single Skin Failures
Secrets Behind the Surface
Shape of Plastics, The
Silicones
Thermoplastics
To Shape Tomorrow
Transfer Molding--Molding a Part with Inserts
World of PVC, The
Your Miniature World
Physical Chemistry of Polymers
Resin

Video Cassettes, Filmstrips, Slide Sets

Introduction to Plastics
Separating, Finishing, and Combining
Casting Plastics
Thermoforming Plastics
Coating and Laminating

Trade Publications

These publications are available free from firms that publish them. They contain many information articles.

Industrial Research, Beverly Shores, IN 46301
Polygram, Mobay Chemical Co., Penn-Lincoln Parkway West, Pittsburgh, PA 15205
DuPont Magazine, Wilmington, DE 19898
Rohm and Haas Reporter, Independence Mall West, Philadelphia, PA 19105
The ABC's of Modern Plastics, Union Carbide Corporation Chemicals and Plastics Dept., 270 Park Ave., New York, NY 10017
Glossary of Plastics Terms, Phillips Petroleum Company, Chemical Department, Bartlesville, OK 74003
Monsanto Magazine, Monsanto Chemical Co., 800 N. Lindberg Blvd., St. Louis, MO 63166

Association and Industrial Publications

Boonton Molding Co., 300 Myrtle Ave., Boonton, NJ 07005, A Ready Reference for Plastics, 13th Ed., 1973
Burlington Industries, Greensboro, NC, Textile Fibers and Their Properties, 1970, p. 63
Dow Chemical—USA, Midland, MI 48640
- Fundamentals of Injection-Molding Technology
- Troubleshooting Injection-Molding Technology

DuPont de Nemours & Co., E. I. Plastics Department, Wilmington, DE 19893
- Blow Molding of Alathon Polyofin Resins, p. 28
- Extrusion Coating, p. 16
- The Extrusion of Polyethylene Film, p.32

Fry Plastics International, Inc., 8601 S. Figueroa St., Los Angeles, CA 90003
- The Story of Acrylics, 1963, p. 56
- The Story of Cellulose, 1963, p. 56
- The Story of Nylons, 1964, p. 44
- The Story of Polyethylene, 1963, p. 56
- The Story of Vinyls, 1963, p. 56

Gen-O-Lite Plastics, North Hollywood, CA, Polyester and Fiberglass, by Maurice Lannon, 1969, p. 121
Gulf Oil Company, Chemical Row, Orange, TX 77630, A Short Course in Blow Molding Linear Polyethylene, p. 31
Kamweld Products Company, Norwood, MA, Handbook for Welding and Fabricating Thermoplastic Materials, by S. J. Kaminsky and J. A. Williams, 1964, p. 176
Laramy Products Company, Cohasset, MA, Making Better Plastic Welds, by Donald W. Thomas, 1962, p. 64
Monsanto Company, 800 N. Lindberg Blvd., St. Louis, MO 63166, The Fundamentals of Blow Molding, Bulletin No. 5023B, p. 29
Morgan Industries, 3311 E. 59th St., Long Beach, CA 90805, Cutting Costs in Short-Run Plastics Injection Molding, revised edition, 1973, p. 105
National Association of Manufacturers, 277 Park Ave., New York, NY 10017

Productivity and Production in Industry, p. 14
Industrial Research and Development, p. 14
The Role of Marketing, p. 14
Wages and Prices in an Industrial Economy, p. 10
Industry's Profits, p. 10
National Board of Fire Underwriters, 85 John St., New York, NY 10038, Fire Hazards in the Plastics Industry, p. 70
Shell Chemical Company, 1 Shell Plaza, Houston, TX 77002, Blow Molding Troubleshooting Guide, p. 18
Society of the Plastics Industry, Inc., 250 Park Ave., New York, NY 10017, The Story of the Plastics Industry, 1966, p. 40
Union Carbide Corp., 270 Park Ave., New York, NY 10017, Polyethylene Powders for Rotational Molding, p. 33
U.S. Industrial Chemicals Company, 99 Park Ave., New York, NY 10016
Coating Fabrics with Microthene Polyethylene Powder, p. 16
Blow-Up Ratios in Blown Film Extrusion, p. 5
Microthene Dispersions for Metal Coating, p. 6
Microthene Microfine Polyolefins—An Introduction, p. 12
Molding Microthene Polyethylene Powder, p. 17
Petrothene Polyolefins—A Processing Guide, p. 151
Polyethylene Blow Molding—An Operating Manual, p. 72
Polyethylene Extrusion Coating—An Operating Manual, p. 64
Polyethylene Film Extrusion—An Operating Manual, p. 56
Rotational Molding of Microthene Polyethylene Powder, p. 24